Readability, Quality and Content of Online Information for Otitis Media in English

Julia Lee

A thesis submitted in partial fulfilment of the requirements for the

Degree of Master of Audiology

Department of Communication Disorders

University of Canterbury

2020

Acknowledgements

First and foremost, I would like to thank my supervisor Rebecca Kelly-Campbell. Thank you for all the time and effort you dedicated into this project. I appreciate the continuous guidance that you provided not only during this year but throughout my Master's degree. Thank you also to my secondary supervisor, Megan McAuliffe, for organising meetings, providing feedback, and always being there whenever help was needed.

Thank you to my family and friends for all the support throughout my five years of university. Thank you to my parents, Mark and Sylvia, for giving me the opportunity to continue learning and create new milestones. Without your help, none of this would have been possible. A big thank you to my friends from both Christchurch and from back home, for always checking in on me, listening to me and providing endless words of encouragement. All your love and positivity does not go unnoticed.

Last of all, thank you to my classmates. Thanks for the many laughs, tears, stressful yet memorable times we've shared together. These last two years have been so much more rewarding than I had imagined. You have been the most enjoyable bunch to do university and life with so thank you.

Abstract

Purpose: This study analysed the readability, quality and content of online information for otitis media (OM) in English.

Method: Seven search terms ("ear infection," "ear infection symptoms," "ear infection signs," "ear pain," "sore ear," "ear infection in adults," and "ear infection treatment") were entered into 21 country-coded Top-Level Domains (ccTLD) on Google. The first ten webpages that met the inclusion criteria were selected. A selection of webpages was chosen for analysis. The locality and type of organisation for each webpage were recorded. Readability was assessed using the formulas FOG (Gunning Fox Index), SMOG (Simple Measure of Gobbledygook) and F-K (Flesch-Kincaid). Quality was determined by the presence or absence of HON (Health on the Net) code certification. Content was analysed using the DISCERN, PEMAT (Patient Education Materials Assessment Tool) and Plain Language Checklist.

Results: Readability of OM-related online information was high. DISCERN scores showed a 'below-moderate' rating. Understandability, actionability, and use of plain language was adequate. There was an uneven distribution of webpages based on types of organisation. There was a significant difference in the DISCERN scores based on types of organisation but no significant difference based on locality. There was no significant difference in the PEMAT scores or plain language scores based on locality or type of organisation.

Conclusions: Improvements in the readability, quality and content should be made by webpage developers and health care professionals to ensure that OM-related online information is beneficial for readers. Education on the condition including its prevalence, causes, and symptoms is critical in making informed treatment choices for individuals themselves or their significant others.

Table of Contents

List of Abbreviations

ACP	Advance Care Planning
ALL	Adult Literacy and Life
ANOVA	Analysis of Variance
AOM	Acute Otitis Media
ccTLD	Country-coded Top-Level Domains
CSOM	Chronic Suppurative Otitis Media
ENT	Ear Nose and Throat Specialist
FRE	Flesch Reading Ease
FRES	Flesch Reading Ease Score
F-K	Flesch-Kincaid
FOG	Gunning Fox Index
HL	Hearing Loss
HON	Health on the Net
HRQOL	Health-related Quality of Life
ICC	Intraclass Correlation Coefficient
OM	Otitis Media
OME	Otitis Media with Effusion
ORL	Otorhinolaryngology
PEMAT	Patient Education Materials Assessment Tool
PIAAC	Programme for the International Assessment of Adult Competencies
NZ	New Zealand
RAOM	Recurrent Acute Otitis Media
RGL	Reading Grade Level
SDM	Shared Decision Making
SMOG	Simple Measure of Gobbledygook

UK	United Kingdom
URL	Uniform Resource Locator
URTI	Upper Respiratory Tract Infection
USA	United States of America
WHO	World Health Organisation

List of Tables

Chapter 1: Introduction

1.1 Hearing Loss

Hearing loss (HL) is a chronic health condition that can have a significant impact on individuals. The World Health Organization (WHO) estimates that 6.1% of the world's population has a disabling HL (World Health Organisation, 2019). WHO suggests that the number of people with disabling HL is expected to increase from 466 million people to over 900 million in 2050 due to the growth and ageing of the global population (World Health Organisation, 2019).

HL is associated with poorer well-being in all aspects of life including the physical, psychological and social domains (Chia et al., 2007). These negative effects have been found in individuals even with mild levels of HL (Newman, Jacobson, Hug, & Sandridge, 1997; Scherer & Frisina, 1998). Individuals with limited auditory access experience communication difficulties that would otherwise form the foundation of social interaction (Heine & Browning, 2002). As a result, HL can have a significant impact on an individual's ability to partake in daily activities that affect their quality of life (Cacciatore et al., 1999). This restriction can instigate withdrawal from social situations and heighten negative emotions (Scarinci, Worrall, & Hickson, 2008). Studies have demonstrated that HL can bring about depression, anxiety, poor cognition and mental health; all of which can often be experienced by individuals with HL themselves or their significant others (Cacciatore et al., 1999; Carlsson et al., 2015; Scarinci et al., 2008).

As for children, HL has a detrimental effect on speech and language development (Psarommatis et al., 2001). Children may also experience educational, social, psychological and behavioural problems in comparison to those with normal hearing (Stevenson, Kreppner, Pimperton, Worsfold, & Kennedy, 2015; Yoshinaga-Itano & Apuzzo, 1998). Early identification of HL and intervention services can provide access to a child's environment

(Yoshinaga-Itano & Apuzzo, 1998). This can result in improved outcomes such as better speech production, receptive and expressive language ability and functional performance (Yoshinaga-Itano & Apuzzo, 1998).

Although the most common intervention for HL is associated with conventional hearing aids, there are many rehabilitation methods that can be effective in reducing the negative consequences of HL (Boothroyd, 2007). Historically, a paternalistic approach dominated the rehabilitation process (Laplante-Lévesque, Hickson, & Worrall, 2010). However, client involvement has been highly recommended to establish goals that are targeted towards the needs of the individual (Laplante-Lévesque et al., 2010). Shared decision making (SDM) is a collaborative approach whereby the health professional and the patient share information to ultimately make a treatment decision (Elwyn et al., 2010). As this model for clinical practice continues to develop, it is important to understand that there are many factors that influence an individual's rehabilitation decisions (Laplante-Lévesque et al., 2010). This includes factors such as financial costs, convenience and other people's experiences and recommendations (Laplante-Lévesque et al., 2010).

Many individuals will have different factors and preferences that will determine what treatment choices they make (Laplante-Lévesque et al., 2010). However, providing high quality information forms the fundamental block in achieving SDM (Laplante-Lévesque et al., 2010). This process is critical for improving patient understanding about their health problem (Laplante-Lévesque et al., 2010). Consequently, increased knowledge will encourage individuals to become more confident and facilitate their own decision making (Bae, 2017; Stacey et al., 2011). Thus, this will promote uptake and adherence to treatment which will ultimately result in better health outcomes (Hughes et al., 2018).

1.2 Otitis Media

1.2.1 Overview

Otitis Media (OM), glue ear, or ear infection, is a group of complex inflammatory diseases that occur in the middle ear and middle ear mucosa (Qureishi, Lee, Belfield, Birchall, & Daniel, 2014b). The middle ear is an air-filled space that contains the three ossicles (malleus, incus and stapes), with the eustachian tube, tympanic membrane, mastoid air cells, and the inner ear all in close proximity (Qureishi et al., 2014b). There are important surrounding structures including the brain, meninges and the sigmoid sinus (Qureishi et al., 2014b). Thus, infection in this space can spread to these structures and increase the risk of complications (Qureishi et al., 2014b; Yuce, Polat, Onder, Dogan, & Muderris, 2013). Extracranial complications occur most commonly, including mastoiditis, tympanic membrane perforations and cholesteatomas (O'Connor, Perry, & Lannigan, 2009). Intracranial complications such as bacterial meningitis, brain abscess and sinus thrombosis are less common (O'Connor et al., 2009).

OM is a spectrum of diseases that presents with different signs, clinical symptoms, complications and treatment (Schilder et al., 2016; Senturia, Bluestone, Lim, Klein, & Paradise, 1980). The three main types are: acute OM (AOM), OM with effusion (OME) and chronic suppurative OM (CSOM) (Schilder et al., 2016). AOM tends to affect children under 2 years of age and typically presents with signs of pain and fever (Qureishi, Garas, Mallick, & Parker, 2014a). Acute suppurative OM is a subtype of AOM whereby there is the accumulation of pus in the air-filled cavity (van Zon, van der Heijden, van Dongen, Burton, & Schilder, 2012). If there is a perforation in the tympanic membrane, discharge of pus can occur (Berger, 1989). Acute mastoiditis is a complication of AOM where patients may experience post-auricular swelling and pain in the mastoid region (Qureishi et al., 2014b).

Complicated AOM typically requires surgery if not cleared with intravenous antibiotics (Qureishi et al., 2014b).

OME tends to affect children between 3 and 7 years old (Qureishi et al., 2014b). It is characterised by the sole accumulation of glue-like fluid in the middle ear without symptoms such as pain and fever (van Zon et al., 2012). Thus, it is commonly known as 'glue ear.' HL caused by OME can often be transient as the effusion can resolve spontaneously (van Zon et al., 2012). However, persistent OME can lead to a delay in speech and language development and result in other educational, social or behavioural development issues (van Zon et al., 2012).

CSOM is most common among children of 2 to 5 years of age (Kamal, Joarder, Chowdhury, & Khan, 2004; Mittal et al., 2015). It is defined as persistent suppurative middle ear inflammation that is often present with a perforated tympanic membrane (Qureishi et al., 2014b; Yuce et al., 2013). CSOM can be present with or without cholesteatomas, whereby keratinizing squamous epithelium replaces modified respiratory epithelium which normally lines the cavity (Qureishi et al., 2014b). The chronic and multifaceted nature of the disease often results in patients requiring treatments including antimicrobial agents and surgery (Qureishi et al., 2014b).

1.2.2 Prevalence

OM is one of the most common causes of health care visits and antibiotic prescriptions worldwide (Qureishi et al., 2014b; Tong, Amand, Kieffer, & Kyaw, 2018). It is thought that almost all children have at least one episode of AOM by 3 years of age (Klein, 1989). Peak incidence is between 6 and 15 months of age (Klein, 1989). Recurrent AOM affects between 10% and 20% of children by 1 year of age and up to 40% of children can have six or more total episodes (Kero & Piekkala, 1987; Sipila, Karma, Pukander, Timonen, & Kataja, 1988; Teele, Klein, & Rosner, 1989). A cohort study carried out by Gribben,

Salkeld, Hoare, and Jones (2012) investigated the number of AOM cases in primary care facilities in New Zealand (NZ) over a 1-year period. Approximately 273 per 1000 children below 5 years of age had AOM and 74% of children had one episode of AOM (Gribben et al., 2012).

OME is the leading cause of transient HL and can affect up to 80% of children at some stage in their lifetime (Qureishi et al., 2014b). The incidence of new cases of OME is approximately 2.2 million annually in the United States of America (USA) (Shekelle et al., 2002). Moreover, a recent worldwide systematic review estimated 31 million cases of CSOM, with approximately 20% being present in children below 5 years of age (Monasta et al., 2012). OM-related HL was estimated to be present in 30.82 per 10,000 population and 21,000 deaths were due to OM-related complications (Monasta et al., 2012). Thus, it is evident that OM is a significant source of morbidity and mortality.

The prevalence of adult-onset OM is much lower than in children (Qureishi et al., 2014b). Its prevalence is predominantly associated with pre-existing conditions such as paranasal sinus disease, adenoidal hypertrophy and smoking-induced nasopharyngeal lymphoid hyperplasia (Finkelstein et al., 1994). As a result, adults with OM are evaluated for these types of conditions and are treated accordingly (Qureishi et al., 2014b).

1.2.3 Aetiology

The aetiology and pathophysiology of OM is complex and multifactorial (Qureishi et al., 2014b). There are different inflammatory stimuli responsible for OM including viruses, bacteria and allergies (Qureishi et al., 2014). The inflammatory process associated with OM is most commonly followed by a viral upper respiratory tract infection (URTI) (Qureishi et al., 2014b). An URTI causes bacteria to colonise, adhere to existing cells and proliferate into the middle ear space (Murphy et al., 2013). Mucosal accumulation and congestion disturbs normal eustachian tube function and alters the pressure within the middle ear space (Qureishi

et al., 2014b). Prolonged stimulation of an underlying inflammatory response damages the cleaning mechanisms of the middle ear and causes an accumulation of middle ear secretions (Rovers, Schilder, Zielhuis, & Rosenfeld, 2004). The adenoids, which usually have an important role in fluid and cell immunity, can also act as a reservoir for bacteria to invade the middle ear space (Saafan, Ibrahim, & Tomoum, 2013). Recurrent attacks can result in a permanent perforation, development of mucosal metaplasia and progressive resorption of the ossicles which can reduce its mobility (Qureishi et al., 2014b; Salomonsen, Hermansson, & Caye-Thomasen, 2010).

There are several reasons why there is a higher prevalence of AOM and OME in children than in adults. The eustachian tubes are smaller, more flexible and horizontally positioned compared to adults which are larger, more rigid and in an oblique position (Qureishi et al., 2014b). The eustachian tube matures by approximately 7 years of age (Qureishi et al., 2014b). Thus, the incidence of OM declines as the eustachian tube and immune system develops (Qureishi et al., 2014b). Due to this anatomical difference, individuals with craniofacial abnormalities including cleft palate and Down syndrome have a higher risk of developing OM (Balkany, Downs, Jafek, & Krajicek, 1978; Schwartz & Schwartz, 1978).

Various risk factors have also been postulated to increase the propensity of infection. This involves host-related factors such as allergies, seasonal factors particularly in colder months (Casselbrant et al., 1999), day care attendance (Rasmussen, 1993) and exposure to chemicals contained in tobacco smoke (Hoffman et al., 2013). However, not all factors have been associated with negative consequences. A systematic review carried out by Bowatte et al. (2015) found that breastfeeding may exert a protective effect against AOM until 2 years of age. This finding suggests that protection may be greater for longer durations of breastfeeding and for exclusive breastfeeding (Bowatte et al., 2015).

1.2.4 Diagnosis

There are many guidelines that help clinicians diagnose different types of OM (Qureishi et al., 2014b). For example, The American Academy of Pediatrics (2004) developed an evidence-based guideline for health professionals to use. Symptoms of AOM include pain, fever, discharge, fatigue and vomiting (Qureishi et al., 2014b). The presence of a bulging tympanic membrane with pain or redness visible with pneumatic otoscopy is highly indicative of AOM (Venekamp, Damoiseaux, & Schilder, 2014). Reduced or absent movement of a non-perforated tympanic membrane detected by tympanometry can indicate the presence of fluid (Shaikh, Hoberman, Kaleida, Ploof, & Paradise, 2010). If a child has three episodes of AOM within a 6-month period, or four in 1 year, this is known as recurrent AOM (RAOM) (Whittemore, 2013).

OME is characterised by the presence of fluid behind the tympanic membrane without the features seen in an acute infection (Qureishi et al., 2014b). It may occur spontaneously or as a residual effect of AOM (Qureishi et al., 2014b). There may also be parental suspicion of OME including hearing difficulties (e.g., asking for repeats, mishearing when not facing towards you, difficulty in group situations), delayed speech and language development, poor attention, social and behavioural problems (Kontiokari, Koivunen, Niemela, Pokka, & Uhari, 1998; Qureishi et al., 2014b).

Otoscopy is critical in diagnosing OM as its sensitivity and specificity is quoted at 90% and 80%, respectively (Bluestone & Cantekin, 1979). Clinical indications of OME includes a dull colouration and retraction of the tympanic membrane, and air-fluid levels (Anwar, Khan, Rehman, Javaid, & Shahabi, 2016). Pure tone audiometry typically shows a conductive HL with elevated air conduction thresholds and normal bone conduction thresholds (Qureishi et al., 2014b). However, those with chronic infection can progress into having a permanent conductive loss, sensorineural or mixed HL (Qureishi et al., 2014b). CSOM is diagnosed with otoscopy in the presence of a permanent perforated tympanic

membrane accompanied by discharge, which persists for two to six weeks (Morris & Leach, 2009a). CSOM is typically distinguishable from AOM as the discharge persists for a longer duration and pain is not the most noticeable feature (Qureishi et al., 2014b).

1.2.5 Treatment

Pain assessment and ongoing management is necessary in order to treat existing episodes, and to reduce the risk of complications (Qureishi et al., 2014b). Antibiotics are not routinely provided in the initial stages of AOM as the majority of children have spontaneous relief within a few days without treatment (Qureishi et al., 2014b; Rovers et al., 2004). It is considered in children aged < 6 months, aged < 2years with bilateral AOM regardless of its severity, those with accompanying perforation, with systemic symptoms and those who have not improved following 48 hours of watchful waiting (Morris & Leach, 2009b). A study carried out by Lee et al. (2014) found that bacteria cultured from children with all subtypes of OM had higher antibiotic sensitivity and were more susceptible to antibiotics compared to bacteria from adults with OM. This suggests that antibiotics are an effective method of remediating symptoms of OM (Lee et al., 2014). However, delaying antibiotic therapy can often be preferable in reducing other issues that may emerge including health-related costs, side effects of treatment, and most importantly, antibiotic resistance (Eskin, 2004).

Ventilation tube or grommet insertion is the preferred procedure if RAOM is associated with persistent discharge, if OME is bilateral, or if it does not clear in less than 3 months (Rosenfeld et al., 2013). Grommets can be effective in ventilating the middle ear space and draining any accumulated fluid (Qureishi et al., 2014b). Consequently, it can improve hearing, reduce the prevalence of effusion and reduce the incidence of RAOM (Rosenfeld et al., 2013). Adenoidectomy may also be considered, typically in combination with grommet insertion if the child is experiencing frequent or persistent URTI (Boonacker et al., 2014). Current United Kingdom (UK), US and NZ guidelines recommend a 3-month

period of watchful waiting (American Academy of Family Physicians American Academy of Otolaryngology-Head Neck Surgery American Academy of Pediatrics Subcommittee on Otitis Media With Effusion, 2004; Leach & Morris, 2006; Mills et al., 2015). During this time, audiometry and other hearing assessments are carried out to keep track of the child's audiological status (Qureishi et al., 2014b). This is critical in determining whether OM is having a significant impact on the child's general development (Qureishi et al., 2014b).

The definitive management of CSOM is often surgical involving techniques to repair the perforated tympanic membrane and remove existing infection (Qureishi et al., 2014b; Reiss & Reiss, 2010). This approach is appropriate to reduce bouts of recurrent discharge and associated HL (Woodfield & Dugdale, 2008). The most common conservative procedure to treat CSOM is aural toileting accompanied with topical antimicrobial agents (Mittal et al., 2015). Many of the ear drops are currently based on quinolones and aminoglycosides (Morris & Leach, 2009a). There are concerns about the potential side effects of ototoxicity with the use of aminoglycosides (Morris & Leach, 2009a). However, it is generally thought to be safe if it is not routinely prescribed and is much less harmful than the infection itself (Phillips, Yung, Burton, & Swan, 2007).

OM has a detrimental impact on both the child and caregiver. A study by Rosenfeld (2000) found that 88% of caregivers were concerned about their child's ear infections, with 44% spending their time at home worrying about their child's condition. Negative physical symptoms was an issue for 85% of children, emotional distress for 76%, and activity limitations for 57% (Rosenfeld, 2000). Previous studies have primarily focused on short-term effects of OM and how grommets affect health-related quality of life (HRQOL) (Damoiseaux & Rovers, 2011; McDonald, Langton Hewer, & Nunez, 2008). A study carried out by Ryborg et al. (2014) followed children with OM and obtained information about their experiences during a 1-year period. The findings showed that HRQOL was significantly improved after 1 year as the initial problems subsided (Ryborg et al., 2014). The improvement in HRQOL was

significantly lower in children whose parents had taken time off work compared to those who were not absent from work which proves how distressing it can be for both children and their caregivers (Ryborg et al., 2014).

It is not uncommon for clinicians to follow different clinical criteria and guidelines. Although this is important to employ in clinical practice, discussions regarding management and treatment options is a critical process of SDM between health care professionals and caregivers (Rosenfeld et al., 2013). It is important that health care professionals incorporate their own clinical judgement, cultural values of the family and set realistic expectations to assist with the SDM process (Rosenfeld et al., 2013). In doing so, it is likely to positively affect a patient's understanding and the child's developmental progress.

1.3 Health Education

1.3.1 Definition of Health Literacy

Health communication is a fundamental tool directed towards preventing disease and improving health outcomes (Nutbeam, 2000). The concept of health literacy has been traditionally described as one's ability to abide by prescribed treatments (Ad Hoc Committee on Health Literacy for the American Council on Scientific Affairs, 1999). Since then, the definition of health literacy has developed into focusing on how different types of literacy affect daily life (Nutbeam, 2000). Health literacy is classified into three levels: basic or functional literacy, communicative literacy and critical literacy. Basic literacy involves having the fundamental literacy skills to be able to function in daily activities (Nutbeam, 2000). Communicative literacy is described as having more advanced cognitive and social skills to actively participate in those daily activities. It involves the ability to draw out key messages and to be able to apply that information in relevant situations (Nutbeam, 2000). Critical literacy focuses on the skills required to critically analyse information so that

individuals are able to take control over daily activities (Nutbeam, 2000). Increased understanding can enable individuals to take responsibility over maintaining their own health (Nutbeam, 1986). Thus, the concept of health literacy should be regarded as a potential asset that can offer an opportunity for individuals to enhance their learning (Nutbeam, 2008).

1.3.2 Prevalence of Low Health Literacy

Low health literacy is more common among certain populations. These are males, ethnic minorities, non-native English speakers, individuals who are aged 65 years and older, adults who did not attend or completed high school, and are not currently enrolled in school, individuals with low socioeconomic status and low income levels, and also those with compromised health status (Bostock & Steptoe, 2012; Kutner, Greenberg, Jin, & Paulsen, 2006). Thus, this suggests that those with HL are likely to have low health literacy, and therefore, have limited knowledge of their medical condition and limited awareness of preventive health services (Atcherson et al., 2014; Naseribooriabadi, Sadoughi, & Sheikhtaheri, 2017).

The 2003 National Assessment of Adult Literacy (Kutner, Greenburg, Jin, & Paulsen, 2006) reported that 36% of U.S. adults had basic or below basic health literacy (Kutner et al., 2006). They had skills that allowed them to partake in daily activities that were uncomplicated (Kutner et al., 2006). This included the ability to identify, read and understand only simple documents (Kutner et al., 2006). Similarly, the 2006 Adult Literacy and Life Skills (ALL) Survey investigated the literacy levels of the New Zealand adult population (Ministry of Health | Manatū Hauora, 2010). On average, New Zealanders had poor literacy skills, with Māori scoring below the minimum score necessary for individuals to meet the demands required in daily life. Among all New Zealanders, low literacy was significantly higher in males, individuals with lower levels of education, individuals who are unemployed or looking for work, and individuals with lower household incomes. The Programme for the

International Assessment of Adult Competencies (PIAAC) included an international survey providing updated information of the adult population following the 2006 ALL Survey. Their predictive model suggested little effect on skill distribution even with changes in the demographics of the adult population including factors such as age and education. While there had been significant growth in the provision of programmes to upskill their literacy levels, it would likely only reach a small proportion of individuals with low literacy levels.

1.3.3 Effects of Low Health Literacy

It is well documented that low health literacy is associated with poorer health outcomes and poorer use of health care services (Berkman et al., 2011). A systematic review by Dewalt, Berkman, Sheridan, Lohr, and Pignone (2004) suggested that low health literacy is associated with increased hospitalizations and use of emergency services, poorer ability to demonstrate taking medications correctly, poorer overall well-being and higher mortality rates. Although these findings have been consistently reported in previous literature, it is important to recognise that there are potential mediators that may explain the causal pathway between health literacy and health outcomes (Berkman et al., 2011). These factors include the individual's limited health-related knowledge, self-efficacy and beliefs related to their disease (Berkman et al., 2011). Currently, there is a need for more research that includes control variables based on a causal model or analytic framework to clarify the effect between health literacy and outcomes (Berkman et al., 2011; Dewalt, Berkman, Sheridan, Lohr, & Pignone, 2004).

Low health literacy has a significant impact on how individuals cope with their health problem. Individuals with limited literacy skills have shown to search less for health information, select different sources that may not be the most informative, and have reduced ability navigating health care systems (Diviani, van den Putte, Giani, & van Weert, 2015). They have difficulty recognising the first signs of a medical problem, are less likely to use

preventative services, and are unable to effectively manage their condition (Berkman et al., 2011; Easton, Entwistle, & Williams, 2013; Ishikawa & Yano, 2008). It is evident that health literacy is not merely an issue of a small minority; nor is it an individual patient's deficit (Kickbusch, Maag, & Wait, 2006). It is an issue that involves citizens, patients, professionals and politicians (Kickbusch et al., 2006). Thus, active improvement in health communication on a society level is critical in overcoming health inequalities, and subsequently improving the general health of populations.

1.3.4 Improving Low Health Literacy

There are different strategies that have been implemented into health care systems worldwide to emphasise the importance of improving health literacy. The National Action Plan to Improve Health Literacy in the US (U.S. Department of Health and Human Services Office of Disease Prevention and Health Promotion, 2010) describes 7 strategies that involve developing and incorporating evidence-based practices in the community. It involves building partnerships and changing policies in a way that is not only linguistically appropriate but also culturally appropriate. The Framework for Health Literacy in NZ (Ministry of Health | Manatū Hauora, 2015) describes a system that includes establishing organisations that focus on improving health literacy on a national scale as well as providing individual support. It involves practices that are relevant for health care professionals, organisations, policy makers, communities, individuals and their communication partners (Benjamin, 2010).

Health care professionals should recognise the effects of low health literacy to know how to improve it. A study by Atcherson, Zraick, and Hadden (2013) found that audiologists were aware that low literacy could be a barrier for patients. However, they had limited awareness of important information such as the average adult reading grade level, and the financial burden of health care costs associated with low health literacy (Atcherson, Zraick, & Hadden, 2013). Audiologists are encouraged to educate patients about their health problem

and ensure that they understand the information that is provided to them. This study suggests audiologists must be educated on health literacy awareness so that they can provide information or employ communication styles that is suitable for their patients (Atcherson et al., 2013). Although this study was aimed at audiologists, it is highly likely that is applicable for all health care professionals.

Written communication is one of the most prevalent forms of communication within health care (Vermeir et al., 2015). Many patients value written information both as a form of entitlement and a resource for self-management (Grime, Blenkinsopp, Raynor, Pollock, & Knapp, 2007). Health care professionals often provide supplemental written information to encourage patients to comply to treatments (Grime et al., 2007). Although the provision and access to written health information is important, it is critical that these educational materials are readable. Thus, writing information at an acceptable readability level can help reduce the literacy demands placed on individuals and encourage patients to better understand and remember the information (Hoffmann & Worrall, 2004; Nutbeam, 2006).

This is particularly important for individuals with HL and OM. A study by Pianosi, Chorney, Corsten, Johnson, & Hong (2016) evaluated parent recall of surgical benefits and risks in paediatric otolaryngology procedures including grommet insertion. Pianosi et al. (2016) found that parents had low rates of recall and were likely to recall the benefits of the surgery as opposed to the risks. This is concerning as understanding the risks may have a significant influence on a parent's perspective of the surgery. A mismatch in understanding could alter their decision-making process and ultimately result in poorer patient outcomes. This study suggests that strategies are needed to improve parental understanding. As with many health problems, there is a substantial amount of information related to OM that is important for individuals to understand. Thus, providing readable educational materials can be an effective way in bridging the health literacy gap and subsequently improving patient's self-efficacy.

1.3.5 Self-Efficacy

Self-efficacy is the perceived capability of an individual to achieve desired behaviours (Bandura, 1977, 1986, 1997, 2004). It is a concept that involves the combination of personal and environmental factors that affects what actions they may take (Bandura, 1977). Therefore, individuals can have a high self-efficacy in one area, but low self-efficacy in another depending on the situation. Low self-efficacy is a self-limiting process that can lead to individuals becoming less motivated and less confident even though they are capable to participate (Bandura, 1977).

A study by Meyer, Hickson, and Fletcher (2014) concluded that writing health information at the recommended readability levels and engaging in strategies that improve low health literacy could improve self-efficacy. This includes methods such as counselling, engaging family members or peers and using readable resources to assist patients in making informed health decisions. More recently, Donald and Kelly-Campbell (2016) evaluated the readability, comprehension, and sense of self-efficacy of an existing and revised paediatric diagnostic audiology report which was altered to fit best practice guidelines. The existing report was difficult to read and understand. However, those who read the revised report had significantly greater self-efficacy as well as comprehension than those who read the unrevised report. This highlights the positive effect of developing health information that can be translated to efficacious behaviours (Bandura, 1990).

The relationship between internet health information use and self-efficacy has been well documented. Internet use is positively correlated to self-efficacy variables including sharing feelings of concern and actively participating in treatment plans (Bass et al., 2006). Individuals with the desire to seek help online will also be motivated to deliberate the information they have obtained (Chen, Li, Liang, & Tsai, 2018). This emphasises the significant influence that internet use has on an individual's medical decision-making process (Chen et al., 2018). Thus, health care professionals should be able to deliver services that are

flexible and regard the internet as a potential support network that can be used in conjunction with their care (Powell, Darvell, & Gray, 2003).

1.4 Sources of Health Information

1.4.1 Different Sources of Health Information

The use of mass media sources and interpersonal sources have been found to be beneficial in encouraging health beliefs and behaviours (Redmond, Baer, Clark, Lipsitz, & Hicks, 2010). Mass media sources include newspapers, radio, TV and the internet while interpersonal sources include family, friends, and healthcare providers (Redmond et al., 2010). The influence of media and social networks on an individuals' behaviour is dependent on their perception of these two sources. Factors such as trust, ease of access, and familiarity is likely to have an effect on what source of information they prefer over another (Rains, 2007). Moreover, it is likely that they may use different communication channels depending on what circumstances they are in.

As the internet has become increasingly more common, new platforms have emerged that have allowed individuals to share information in a different way (Song et al., 2016). In particular, social media and online support groups encourage individuals to learn about other people's experiences whilst being able to express their own concerns. It empowers individuals to make better lifestyle choices and actively manage their own health (Zhou, Zhang, Yang, & Wang, 2018). Due to the growth in internet use, traditional sources have become less commonly used. For example, Jacobs, Amuta, and Jeon (2017) found that U.S. adults typically used the internet as the first avenue for accessing health information. Those with less internet skill were more likely to turn to family and friends or traditional sources such as books or magazines (Jacobs et al., 2017). Interestingly, many of those who accessed traditional media also used the internet to gain access to another perspective (Rains, 2007).

In a survey conducted in 2010 by the Pew internet Project and California Health Care Foundation, it was found that approximately 80% of internet users in the United States searched for online health information. More than half of these individuals searched for information about a medical problem including treatments or procedures (Pew Research Center, 2011). Approximately 44% of internet users searched for contact information of health care professionals (Pew Research Center, 2011). Another study by Fox and Rainie (2002) found that individuals would use online information alongside information provided by healthcare professionals to assist with their decision-making process. It was uncommon for patients to exclusively use the internet for advice (Fox & Rainie, 2002). This shows that health professionals remain the primary information source and most trusted source for patients (Cutilli, 2010). Thus, it is critical for professionals to recognise the importance patients place on their services.

1.4.2 Accessibility of the Internet

Despite the exponential increase in the amount of online health information available on the internet, there is little that is known about the accessibility of that information (Berland et al., 2001). As the internet is a non-regulated source, it is difficult to control what information individuals access (Fahy, Hardikar, Fox, & Mackay, 2014). Moreover, internet access is exacerbated by the disparities in the use of internet health information (Wagner, Bundorf, Singer, & Baker, 2005). This growing gap between those individuals who have access compared to those who do not is known as the digital divide (Connolly & Crosby, 2014).

Although internet access is a fundamental issue, disparities remain even in the extent to which individuals benefit from having access (Hsu et al., 2005). This difference stems from underlying factors including race, socioeconomic status and level of educational attainment (Fox & Rainie, 2002; Hsu et al., 2005). Individuals who are older, in low income

groups, less educated, live in rural areas, and those individuals who are of ethnic minority are most likely experiencing barriers in accessing information (Hsu et al., 2005; Jackson et al., 2003; Lenhart, Rainie, Fox, Horrigan, & Spooner, 2000). Furthermore, the rates of low health literacy are reportedly higher among these individuals (Kutner et al., 2006).

Patients with chronic conditions such as HL tend to seek online information for assistance (Bundorf, Wagner, Singer, & Baker, 2006). Studies have found that those with HL use the internet more compared to their age-matched peers without HL or the general public (Barak & Sadovsky, 2008; Thoren, Oberg, Wanstrom, Andersson, & Lunner, 2013). They are more likely to use the internet as a communication tool to retrieve information (Barak & Sadovsky, 2008). A study by Meherali, Campbell, Hartling, and Scott (2019) found that parents often used the internet as a secondary source in addition to seeking advice from healthcare professionals. Parents would access the internet to find more information about symptoms of OM, associated treatment and specific home management strategies (Meherali et al., 2019). Another study by Pehora et al. (2015) found that 98% of parents searched for information regarding their child's health. Individuals are increasingly encouraged to become actively involved in their health care process to improve their own understanding and manage their health outcomes (Simmons, Wolever, Bechard, & Snyderman, 2014). Therefore, it is important that those who have access to online health information can use it in a way that is beneficial to them (Tonsaker, Bartlett, & Trpkov, 2014).

1.4.3 Benefits of Online Information

The internet has become an established source for health information (Tonsaker et al., 2014). Studies have found that the perceived benefits of online health information support the theoretical benefits that have been discussed in the literature (Powell, Inglis, Ronnie, & Large, 2011). The internet provides convenient access from any location, at any time and from a diverse range of sources (Powell et al., 2003). It provides an avenue for individuals to

improve their health education and knowledge acquisition (Win, Hassan, Bonney, & Iverson, 2015). Thus, it is a time and cost effective method of contributing to public education (Powell et al., 2011).

The internet also offers potential anonymity and confidentiality so that consumers can access information on sensitive topics (Powell et al., 2011; Robinson, Patrick, Eng, & Gustafson, 1998). It allows them to connect with others who may be able to offer suggestions if they have had similar issues (Powell et al., 2011). It also encourages individuals to interact with their health providers, clarify any misunderstandings, and make informed treatment decisions (Zhou et al, 2018). Therefore, online support functions as an integrated network to allows individuals to actively immerse themselves within the healthcare system (Powell et al., 2011).

1.4.4 Risks of Online Information

Despite the widespread consensus for the internet's ability to improve health, online health information presents some inherent difficulties (Tonsaker et al., 2014). Individuals can often find it difficult to navigate and critically evaluate health information, regardless of their literacy skills (Cline & Haynes, 2001). This difficulty extends to all information seekers including health professionals (Cline & Haynes, 2001). This can be attributed to factors such as the readability and quality of the information. This includes having unspecified target audiences, and often information overload (Chi-Lum, 1999; LaPerriere, Edwards, Romeder, & Maxwell-Young, 1998). Information can often be disorganized and can lack user-friendliness (Cline & Haynes, 2001; McKinley, Cattermole, & Oliver, 1999). This can be due to poor use of technical language, confusing graphical layout and the absence of explicit instructions (Cline & Haynes, 2001).

While the internet can be a valuable resource for consumers, the lack of regulation means that information is of variable quality (Jadad & Gagliardi, 1998; Kim, Eng, Deering,

& Maxfield, 1999). Current approaches have been undertaken to guide the development of high quality online health information (Diviani et al., 2015). This includes promulgating self-regulatory codes of conduct and ethical guidelines to improve the quality and reliability of information (Kim et al., 1999). Although these efforts are useful, individuals may not be able to relate it to their own circumstances (Berland et al., 2001). Many are unable to distinguish between high- and low-quality information (Norman & Skinner, 2006). Thus, it is highly possible that individuals may be trusting information that is misleading and inaccurate (Tonsaker et al., 2014). This effect can be detrimental as it may steer them to make important health decisions that are not relevant to their health situation (Tonsaker et al., 2014). Furthermore, individuals are likely to feel unsettled and increase the tendency to self-diagnose or treat their own condition (Ahmad, Hudak, Bercovitz, Hollenberg, & Levinson, 2006). It is clear that the internet has the potential to eliminate barriers for individuals (Berland et al., 2001). However, this can only be achieved if the material can be easily read and understood by different users (Edejer, 2000; McLellan, 1998).

1.5 Readability

1.5.1 Definition of Readability

Readability provides information on how easily written materials are to read and understand by readers (Freda, 2005). It is an important attribute of written material that affects the way individuals manage their health problem and engage in their healthcare process (Meade & Smith, 1991). Readability improves when the material is written at or below the reading level of the individual (DuBay, 2004). Thus, the intended audience is more likely to stop reading the material if it is at a higher level than the reading level of the reader (DuBay, 2004).

1.5.2 Readability Formulas

Readability is determined through systematic formulas based on sentence length, word length in syllables, and word familiarity (Ley & Florio, 1996; Shieh & Hosei, 2008). It is often expressed as a reading grade level (RGL), and is based on the number of years of education required for an average reader to understand the information (Ley & Florio, 1996). Weiss (2003) recommended that consumer health information be written no greater than the sixth RGL. This RGL was established to improve patient understanding and positively affect health outcomes (Eltorai, Ghanian, Adams, Born, & Daniels, 2014).

Several readability formulas that have been developed to evaluate written health information (Ley & Florio, 1996). These are the Flesch Reading Ease Score (FRES), Flesch-Kincaid Grade Level Formula (F-K), Gunning Fog Index (FOG) and the Simple Measure of Gobbledygook (SMOG) (Ley & Florio, 1996). Previous studies have suggested multiple readability formulas be used to calculate the average RGL (Ley & Florio, 1996). This is in order to account for differences between formulas such as the software processing algorithms and the applications of each formula (Wang, Miller, Schmitt, & Wen, 2013).

1.5.2.1 Flesch-Kincaid Grade Level

The F-K Grade Level is the most widely used tool to assess readability (Boztas et al., 2017). It is a modified version based on the FRE scale which is based on the average number of syllables per word and average number of words per sentence (DuBay, 2004; Kincaid, Fishburne Jr, Rogers, & Chissom, 1975). The scores obtained using FRE range from 0 -100 whereby a score of 30 to 50 is 'difficult,' a score of 60 to 70 is considered 'plain English,' and a score of 80 to 90 is 'easy' and is equivalent to the sixth RGL (DuBay, 2004). This numerical system negatively correlates with other readability formulas. This means that high scores are easy to understand whilst low scores are difficult. As the FRE scores increase, the F-K Grade Level decreases and vice versa.

The F-K estimates to 75% comprehension on a multiple-choice test (Kincaid et al., 1975). Despite its popularity and accessibility, it has been suggested it may not be the most accurate tool when grading literacy materials (McLaughlin, 1974). As the formula is based only on the number of syllables and sentence length, it may underestimate reading difficulty of shorter words or unfamiliar words including medical jargon (Badarudeen & Sabharwal, 2010). The F-K is calculated using the following formula (Kincaid et al., 1975):

$$Grade = .39(average\ number\ of\ words\ per\ sentence) + 11.8(number\ of\ syllables\ per\ word) - 15.59$$

1.5.2.2 Gunning Fox Index

The FOG was developed by Gunning (1952). It estimates 90% comprehension and is based on the average number of words per sentence and the percentage of polysyllabic words (DuBay, 2004). Although it is quick to administer, the tool is not as accessible as FRE and F-K (Badarudeen & Sabharwal, 2010). The FOG is calculated using the following formula:

$$Grade = .4(average\ number\ of\ words\ per\ sentence) + 100\left(\frac{polysyllabic\ words}{total\ words}\right)$$

1.5.2.3 Simple Measure of Gobbledygook

The SMOG formula was developed by McLaughlin (1969). It is based on the number of polysyllabic words in a sample of 30 consecutive sentences (Badarudeen & Sabharwal, 2010). It uses a stricter criterion compared to other formulas as it estimates 100% comprehension ability (Badarudeen & Sabharwal, 2010). Thus, the calculated scores can often be higher than the RGLs obtained from some of the other readability formulas (Badarudeen & Sabharwal, 2010). The SMOG is calculated using the following formula:

$$Grade = 1.0430\sqrt{number\ of\ polysyllables\ x\ \frac{30}{number\ of\ syllables}} + 3.1291$$

1.5.3 Readability of Health Information

Poor readability is a widespread issue that is not restricted to one health condition (Eloy et al., 2012). McInnes and Haglund (2011) examined the readability of information on 22 common causes of burden and mortality in high-income countries including HL. The mean FRE score was 46.08 ('difficult') and the mean RGL was 12.30. The mean RGL of webpages on HL was approximately 11.45. A systematic review by Daraz et al. (2018) supported these findings and found that the mean RGL of online health information in the U.S. and Canada ranged from grade 10-15 based on different readability scales. Stratification by type of organisation, speciality and health condition revealed the same findings suggesting that it is inappropriate for public use (Daraz et al., 2018). This issue is concerning as poor readability can misinform readers and have a detrimental effect on health outcomes (Daraz et al., 2018). Furthermore, individuals with low literacy skills are likely to view health information as being unhelpful if written at a higher reading level (French & Larrabee, 1999). Therefore, additional professional and social support is crucial in compensating for these barriers (Atcherson et al., 2014).

1.5.3.1 Readability of Hearing-related/Otorhinolaryngology (ORL) Information

As with other health conditions, online hearing-related information often exceeds the recommended sixth RGL. Laplante-Lévesque, Brännström, Andersson, and Lunner (2012) found that adults with HL and their significant others on average, required at least 11 years of education to read and understand English-language internet information. Atcherson et al. (2014) found that between 85-100% of hearing-related consumer directed documents on the American-Speech-Language-Hearing Association (ASHA) webpage exceeded the fifth to sixth RGL. This suggests that the average adult would have difficulty reading and understanding speech and hearing-related information on the ASHA webpage. This is

problematic as although they have reviewed their consumer webpages in the past, there are still many issues that remain.

Joubert and Githinji (2014) found that the RGL of information pamphlets for parents of children with HL ranged from 4 to 10. This wide range is concerning as parents and caregivers are typically the ones accessing information and making health decisions for their child (Joubert & Githinji, 2014). Thus, improvement is required to lessen the stress and burden that parents may feel when their child is unwell (Rosenfeld, 2000). Studies investigating webpages from otolaryngology departments (Svider et al., 2013), and various otolaryngology association webpages (Eloy et al., 2012; Kasabwala, Agarwal, Hansberry, Baredes, & Eloy, 2012) have also found similar results. Developing readable patient education materials can be challenging due to the complexity of conditions in otolaryngology. However, it is necessary for resources to be effective and valuable for consumers.

1.5.3.2 Readability of OM-related Online Information

Readability of OM-related online information has previously been investigated. Joury et al. (2018) assessed 35 webpages using the search terms, "otitis media" and "middle ear infection," into the top internet search engines- Google, Yahoo and Bing. The average webpage was written at a 9^{th}-10^{th} RGL and very few were easy to read. Ritchie, Tornari, Patel, and Lakhani (2016) used the search term "glue ear" and found that the mean readability was suitable for 11-15 year olds. Only 4 of 27 webpages were rated as being of good quality and readability.

Many studies looking at OM-related information have found similar results. McKearney and McKearney (2013) used the search terms 'myringotomy', 'tympanostomy', 'grommet' and 'ear tubes'. The average webpage was written at a reading level of a 10^{th} grade school pupil. Only 22 of 84 webpages obtained a FRE score that was deemed as being

suitable to the general public. Other studies that assessed the readability of online information regarding head and neck conditions (Alamoudi & Hong, 2015), and thyroid surgery (Goslin & Elhassan, 2013) found that more than half of the websites were difficult to read. Although these studies have reported similar conclusions, there has been no study on OM that has used search terms that have been obtained from the public. In general, it is likely that consumers would not use medical terms such as 'otitis media,' 'myringotomy,' and 'grommets,' to search information regarding ear infections. Thus, it is possible that the readability of OM-related information may differ from what has been previously reported.

1.6 Quality

1.6.1 Definition of Quality

There are many quality evaluation tools available including 273 that were identified in a 2004 review, compared to 47 in 1998 (Bernstam, Shelton, Walji, & Meric-Bernstam, 2005; Jadad & Gagliardi, 1998). Although many researchers and regulatory bodies have requested for the establishment of a clear universal standard, defining a single gold standard quality evaluation tool for such a wide range of resources remains to be an ongoing challenge (Robillard, Jun, Lai, & Feng, 2018). This issue often stems from differences in how users define the indicators of quality (Fahy et al., 2014). For example, healthcare professions may want research based information compared to patients who may want simple and direct explanations (Cline & Haynes, 2001). Criteria for determining quality is typically organised by their applicability such as purpose of the content, intended audience, accuracy and reliability of information and authorship (Diviani et al., 2015). Regardless of the criterion, the quality of health information should be constantly scrutinised and tools should be applied to evaluate all online information (McInnes & Haglund, 2011).

1.6.2 HONcode Certification

The Health on the Net (HON) or HONcode, is an 8-point code of conduct for medical webpages. Webpages that have been approved can display a HONcode logo (Health on the Net, 2019). This allows readers to be confident that the information they are accessing meets quality standards (Health on the Net, 2019). The Health on the Net (2019) described the HONcode principles as follows:

1. Authoritative: medical advice only be given by medically trained and qualified professionals.
2. Complementarity: information should support and not replace the patient's relationships with their medical professionals.
3. Privacy: confidentiality of personal data relating to patients and visitors to a medical or health webpage should be respected.
4. Attribution: information should be cited with references and the date of last update is provided.
5. Justifiability: information relating to benefits of a specific treatment should be evidence-based.
6. Transparency: any contact information should be presented in a clear and accessible manner.
7. Financial disclosure: any funding sources should be clearly provided.
8. Advertising policy: advertising should be clearly stated as a source of funding.

1.6.3 Quality of Health Information

As the internet is an unregulated source, the quality of online information largely varies (Fahy et al., 2014). A systematic review by Eysenbach, Powell, Kuss, and Sa (2002) analysed studies containing quantitative data on quality measures of online health information. They investigated the design, readability, accuracy, and completeness of information and found that 70% of the studies were of poor quality (Eysenbach et al., 2002). The authors suggested that strict definitions of each quality criterion are necessary. For example, what constitutes "accuracy" or "attribution." They concluded that health care professionals and webpage developers should be analysing where and why the gaps exist rather than how much of it is a problem (Eysenbach et al., 2002). Thus, it is important that webpage developers adhere to best practice guidelines and target specific areas that may be lacking in order to create quality information (Laplante-Lévesque et al., 2012). Likewise, health care professionals should be able to identify the gaps and guide patients to information that will be beneficial to their patients (Laplante-Lévesque et al., 2012).

1.6.3.1 Quality of Hearing-related/ORL Information

The quality of health information is an ongoing problem given the number of internet searches for health information and the importance individuals place on the information they access (Couper et al., 2010). Laplante-Lévesque et al. (2012) evaluated the quality of online information dedicated for adults with HL and their significant others. They found that only 14% of the webpages had HON certification. This finding was consistent in another study by Manchaiah et al. (2019) which found that only 13.5% of the webpages had HON certification for online English-language information for tinnitus. This indicates that most webpages accessible to the public have no verification of standardized quality certification. Both studies found that webpages of government origin were more likely to have HONcode certification compared to webpages from a commercial and non-profit organisation origin (Laplante-

Lévesque et al., 2012; Manchaiah et al., 2019). Thus, there are specific organisations that are more likely to follow the HONcode certification and re-evaluation process.

1.6.3.2 Quality of OM- related Online Information

The quality of OM-related information has been sparsely investigated. Joury et al. (2018) found that 46% of webpages related to OM were HONcode certified. Less than half of the webpages posted the date, mentioned authorship, and referred to citations and references (Joury et al., 2018). Most of the webpages disclosed financial or sponsor interests (Joury et al., 2018). However, this indicates that almost half of the webpages may not meet quality standards and is likely to be unreliable or misleading (Joury et al., 2018). This is particularly concerning as individuals do not critically analyse the quality of all the information they retrieve online (Diviani et al., 2015). They may be unable to recognise what is important to evaluate or how to go about assessing the information. In particular, this difficulty is enhanced for those with limited health literacy skills who are unable to effectively navigate health care systems (Diviani et al., 2015).

1.7 Content Analysis

1.7.1 DISCERN

The DISCERN (discern.org.uk) is a standardised tool used to assess the quality of health information on treatment choices (Charnock, Shepperd, Needham, & Gann, 1999). It is a tool that provides users with specific guidelines for evaluating information (Charnock et al., 1999). It is applicable to any form of written information (Charnock & Shepperd, 2004).

The DISCERN comprises of 15 items that each represent a separate quality criterion and an overall quality rating at the end of the instrument. Section 1 (items 1-8) focuses on the reliability of the publication whereas Section 2 (items 9-15) focuses on the details of the

information on treatment choices. Item 16 is the overall quality rating which is a subjective rating based on what the user has rated each of the preceding questions. Each question is rated on a scale from 1 to 5 where 1 is given if the quality criterion has not been fulfilled, 2-4 is given dependent on how partially low or high the publication meets the criterion, and 5 is given if the criterion has been fulfilled.

1.7.1.1 Health Information Using the DISCERN

The DISCERN tool has been used to assess the quality of different health conditions and treatment options. A systematic review by Daraz et al. (2019) evaluated the quality of online health information accessible to the public. They investigated information associated with ear, nose, and throat (ENT), anaesthesiology, and paediatric health (Daraz et al., 2019). None of the webpages received a category of 'excellent,' 37-79% were rated as 'good,' and the remaining were rated as 'poor' quality. Government organisations received the highest DISCERN score compared to academic and media-related sources (Daraz et al., 2019). This is an ongoing concern for health information to be of suboptimal quality across various medical specialties. Thus, it is important that improvement in health information occurs in all domains including accessibility, readability, and quality.

1.7.1.2 Hearing-related/ORL Information Using the DISCERN

Laplante-Lévesque et al. (2012) evaluated the quality of information in English for adults with HL and their significant others. The DISCERN scores ranged from 1.13 to 3.93 out of 5, consistent with previous research showing variability in the quality of health information (Azios, Bellon-Harn, Dockens, & Manchaiah, 2019; Batchelor & Ohya, 2009; Kaicker, Debono, Dang, Buckley, & Thabane, 2010; Wallace, Turner, Ballard, Keenum, & Weiss, 2005). Relevance and clarity of treatment choices were the two highest scored items (Laplante-Lévesque et al., 2012). In contrast, clarity of aims and achievement of aims were

the two lowest scored items (Laplante-Lévesque et al., 2012). Webpages from a non-profit organisation had significantly higher DISCERN scores than those from a government or commercial origin (Laplante-Lévesque et al., 2012). This finding was consistent with another study by Manchaiah et al. (2019) which found that the DISCERN scores on tinnitus information ranged from 1 to 5, also indicating variable quality. Although both studies identified strengths and weaknesses of the webpages, it is important to recognise that Laplante-Lévesque et al. (2012) found that all the webpages only partially met the DISCERN quality criteria. None of the webpages obtained a full DISCERN quality rating.

1.7.1.3 OM-related Online Information Using the DISCERN

Quality of OM-related online information using the DISCERN has been investigated. Joury et al, 2017 evaluated online OM-related information using the keywords 'otitis media' and 'middle ear infection.' The DISCERN scores ranged from 20- 69 out of 80 with a mean score of 47 out of 80 (Joury et al., 2018). Clarity of aims, relevance and provision of additional sources of information were the highest scored items (Joury et al., 2018). In contrast, information on the risks of each treatment and how treatment decisions affect quality of life were the two lowest scored items (Joury et al., 2018). This is concerning as incomplete information about possible treatment options can lead to misinformed premature decisions being made (Joury et al., 2018).

Ritchie et al. (2016) assessed OM-related information using the keyword 'glue ear.' The DISCERN scores ranged from 26-75 out of 80 with a mean score of 57 out of 80 (Ritchie et al., 2016). Approximately 40% of the webpages scored above 4 out of 5 indicating that some webpages are likely to aid in treatment choices (Ritchie et al., 2016). Webpages with the highest DISCERN scores used diagrams and audio-visual information to convey messages to the reader (Ritchie et al., 2016). Furthermore, those with the highest DISCERN scores included information on authorship, editing dates and references (Ritchie et al., 2016).

McKearney and McKearney (2013) assessed the quality of online OM-related information using the keywords 'myringotomy,' 'tympanostomy,' 'grommet' and 'ear tubes.' The DISCERN scores ranged from 18-64 out of 80 with a mean score of 38.5 (McKearney & McKearney, 2013). In this study, relevance, description on how the treatment works, and the benefits of treatment were the highest scored items (McKearney & McKearney, 2013). Many of the webpages that provided a description on the short term and long term benefits of treatment were likely to reflect those that were trying to advertise their medical practice (McKearney & McKearney, 2013). In comparison, clarity of aims, references for additional information, support for medical advice were the lowest scored items (McKearney & McKearney, 2013).

Alamoudi and Hong (2015) assessed the quality of information on microtia and aural atresia. The most consistent finding was that high-quality webpages were lacking considerably (Alamoudi & Hong, 2015). In this study, clarity of aims and relevance were the highest scored items (Alamoudi & Hong, 2015). A description on how treatment decisions affect day-to-day life and additional sources of support were the lowest scored items (Alamoudi & Hong, 2015).

These findings were consistent in a study by Goslin and Elhassan (2013) which investigated the quality of online information on common ORL conditions including cholesteatoma and AOM. Most of the webpages were of 'poor' or 'very poor quality,' with only 1.6% of webpages rated as being 'excellent' (Goslin & Elhassan, 2013). Items that were related to the date of publication, balance and bias, and additional sources of support and information were the highest-scoring items (Goslin & Elhassan, 2013). Clarity of aims, treatment risks and those questions related to SDM were the lowest-scoring items (Goslin & Elhassan, 2013). This is concerning as effective SDM between patients and health care providers is valuable in improving affective-cognitive outcomes (Shay & Lafata, 2015).

Furthermore, advising patients about the potential risks of treatment is an essential part of gaining informed consent and decision-making (Goslin & Elhassan, 2013).

These studies show that there is a selection of webpages that are of good quality. There are weaknesses that have been identified as being areas of concern. It is up to healthcare professionals and webpage developers to be aware of the quality of information that is available to the public and direct individuals to those webpages that have a good rating. As previously mentioned, a limitation of current studies on OM-related online information is mainly due to the use of search terms used to obtain the refined list of webpages. It is likely that people seeking online health information may use different terms that are not necessarily medical terms. Therefore, the selection of webpages may be different to those that have been previously assessed.

1.7.2 PEMAT

The Patient Education Materials Assessment Tool (PEMAT) is a systematic tool that can be freely accessed to evaluate the understandability and actionability of printable and audio-visual patient education materials (Shoemaker, Wolf, & Brach, 2014). It was developed by different experts involved in health literacy (Shoemaker et al., 2014). It is the first validated tool that allows individuals to evaluate audio-visual materials (Shoemaker et al., 2014). It comprises of 24 items for printable materials and 17 items for audio-visual materials (Agency for Healthcare Research and Quality, 2019). Each item is rated as either 'agree (1),' 'disagree (0),' or 'not applicable' (Shoemaker et al., 2014). Each webpage generates two separate percentage scores including one for understandability and one for actionability (Shoemaker et al., 2014).

Patient education materials are understandable when readers with different health literacy levels can interpret the material and identify the key messages (Shoemaker et al., 2014). They are actionable when readers can recognise what they can do based on the

information provided to them (Shoemaker et al., 2014). Understandability focuses on content, word choice and style, use of numbers, organisation, layout and use of visual aids (Agency for Healthcare Research and Quality, 2019). Actionability focuses on its ability to give the reader clear actions by addressing them directly and providing tangible tools to assist the reader (Agency for Healthcare Research and Quality, 2019).

1.7.2.1 Health Information Using the PEMAT

The PEMAT has yet to be used to assess OM-related information. However, the tool has been applied to many different patient education materials including diabetes, vocal cord paralysis, and neurosurgical materials (Balakrishnan, Chandy, Hseih, Bui, & Verma, 2016; Kang & Lee, 2019; Lopez Ramos et al., 2019). A study by Gazarian et al. (2019) investigated the understandability and actionability of advance care planning (ACP) patient educational resources. ACP conversations are commonly applied in health care to help patients identify what is important to them in terms of future care (Gazarian et al., 2019). These discussions encourage patient autonomy whilst better aligning with their preferences and the treatment they receive (Lum & Sudore, 2016). Understandability ranged from 58 - 100 with a mean score of 86 (Gazarian et al., 2019). Actionability ranged from 40 - 199 with a mean score of 90 (Gazarian et al., 2019). The most common reason for low understandability was due to a lack of a summary section (Gazarian et al., 2019). The educational resource with the lowest actionability score did not provide any checklists or steps of action (Gazarian et al., 2019). Like the DISCERN, this tool identifies aspects of educational resources that require improvement. Moreover, it focuses on what resources may be beneficial for clinicians to use in preparing patients for future healthcare decisions.

Mastroianni et al. (2019) evaluated the effectiveness of an organisation-wide, evidence-based approach to improve the understandability and actionability of patient educational materials. They initiated a collaborative approach by developing revised

resources in partnership with consumer feedback (Mastroianni et al., 2019). The mean understandability and actionability scores increased by 5% and 4%, respectively (Mastroianni et al., 2019). Although the percentage increases were relatively small, this finding shows that revision of health information following a coordinated health literacy approach can result in improved outcomes (Mastroianni et al., 2019). This also suggests that consumer feedback may be of value in offering noticeable improvements in the quality of patient information.

1.7.3 Plain Language

Effective communication is an important contributor to the practice and delivery of healthcare (Agarwal, Sands, & Schneider, 2010). The Plain Writing Act was mandated in 2010 which required federal agencies in the U.S. to use clear communication in any document accessible to the public (Plain Language Action and Information Network, 2019). While plain language communication has been strongly advocated for, its adoption in healthcare organisations has lagged (Stableford & Mettger, 2007). Resistance has been attributed to a misunderstanding of what plain language is, and what benefits it provides to the patient, health professional, and the health care system overall (Stableford & Mettger, 2007).

The term 'plain language' refers to the delivery of clear and succinct information that can be understood by the individual (Stableford & Mettger, 2007). Information should not be oversimplified, but should be easy to read, user-friendly, and employ evidence-based approaches (Stableford & Mettger, 2007). Readers should be able to extract important messages easily and in a way that makes sense to them (Weiss, 2007). Although its use has been emphasised for those with reduced health literacy, individuals with high health literacy equally benefit from plain language communication (Stephenson, 2006). In times of distress, it can be difficult to take in information regardless of the health literacy level of the individual (Kessels, 2003).

To address this problem, information providers should be aware of the need to implement plain language. Furthermore, they should utilise standardised tools to evaluate the use of plain language. Over time, online resources have been provided with different perspectives on the value of plain language. For example, the Plain English Checklist for Documents (National Adult Literacy Agency, 2019), Quick Checklist for Plain Language (Center for Health Literacy, 2019) and the Checklist for Plain Language on the Web (Plain Language Action and Information Network, 2019) are three examples of quick lists that review the use of plain language of information. These checklists collectively focus on elements such as reader focus, language, structure and design. The demand for consumer understanding of written information is growing (Schillinger & Davis, 2005). Thus, it is important that providers incorporate clear communication as an accepted standard in ongoing information exchange (Stableford & Mettger, 2007).

1.7.3.1 Health Information Using Plain Language

Many studies investigating health information have demonstrated that plain language guidelines could be beneficial in educating patients. Grene, Cleary, and Marcus-Quinn (2017) carried out a systematic review to evaluate the use of plain language guidelines in health information for patients with differing levels of health literacy. They investigated health information such as consent forms, personalised patient discharge letters, and prescription drug warnings (Grene et al., 2017). Patients demonstrated a better understanding when plain language interventions were used, particularly for those with low literacy (Grene et al., 2017).

Another study by Otal et al. (2012) also found similar findings. They assessed the health literacy skills of those that visited a paediatric surgery outpatient clinic and determined patient satisfaction with plain language materials. Approximately 70% of parents had adequate health literacy, and 30% had limited health literacy (Otal et al., 2012). Parents preferred plain language materials, regardless of their literacy level (Otal et al., 2012).

Parents require a certain level of health literacy to understand their child's health condition including cases such as OM (Otal et al., 2012). Without the necessary skills, they may not understand the benefits and risks associated with different treatment options. The effects of this is likely to be detrimental to parents and families, not knowing if they are making the best decision for their child.

1.8 Study Rationale

The internet is becoming an important source for health information. Individuals are searching for online health information to guide their health decisions. This applies to health information on OM. OM is one of the most common paediatric diagnoses often following URTIs. Different treatment methods are carried out for individual's dependent on factors such as age, severity of symptoms, previous history and other accompanying diseases. It is associated with several modifiable risk factors, and the complications of OM is largely preventable. Thus, it is important to have access to quality educational information to be able to recognise the situation and subsequently take appropriate steps of action.

It is well known that much of the readability of online health information is high and the quality of that information is generally of poor quality. This finding is consistent for online information on OM. To date, there has been no study on OM that has used top search terms that have been obtained from informants in the general public. Moreover, the understandability and actionability of online information on OM using the PEMAT, and the use of plain language has yet to be reported. Previous research has continuously advocated for the use of standardised guidelines to create and evaluate health information. Therefore, recognising what exact approaches need to be made will allow health care professionals and webpage developers to manage the quality of health information and focus on those that are appropriate for individuals.

1.9 Aims and Hypotheses

1.9.1 Aims

The aim of this study was to investigate the readability, quality and content of OM-related online information in English.

1.9.2 Hypotheses

The null hypotheses are provided below:

1. There is an even distribution of webpages based on locality.
2. There is an even distribution of webpages based on type of organisation.
3. There is an even distribution of webpages based on HONcode certification.

4. There is an even distribution of webpages within locality based on type of organisation.
5. There is an even distribution of webpages within locality based on HONcode certification.
6. There is an even distribution of webpages within type of organisation based on HONcode certification.

7. There is no significant difference in the mean RGL of webpages from the recommended 6th RGL.
8. There is no significant difference in the mean RGL of webpages based on locality.
9. There is no significant difference in the mean RGL of webpages based on type of organisation.
10. There is no significant difference in the mean RGL of webpages based on HONcode certification.

11. There is no significant difference in DISCERN scores of webpages based on locality.
12. There is no significant difference in DISCERN scores of webpages based on type of organisation.
13. There is no significant difference in DISCERN scores of webpages based on HONcode certification.

14. There is no significant difference in PEMAT scores based on locality.
15. There is no significant difference in PEMAT scores based on types of organisation.
16. There is no significant difference in PEMAT scores based on HONcode certification.

17. There is no significant difference in plain language scores based on locality.
18. There is no significant difference in plain language scores based on types of organisation.
19. There is no significant difference in plain language scores based on HONcode certification.

Chapter 2: Method

2.1 Overview

This study analysed the readability, quality and content of online OM-related information in English. Readability was examined using the formulas FOG, SMOG and F-K. Quality was determined by the presence or absence of HONcode certification. The content was analysed using the DISCERN, PEMAT and Plain Language Checklist. Ethics approval was obtained from the Human Ethics Committee of University of Canterbury to conduct this study (Appendix A1).

2.2 Selection of Search Terms

Participants were recruited and asked what search terms they would use to access online information on OM in English. The participants were recruited through social media (e.g., Facebook). The inclusion criteria for potential participants were: (1) adults over the age of 18 years and (2) able to provide the search terms in the English language. They were given a link to an anonymous survey which was completed online. The survey included a demographic questionnaire about their age, gender, ethnicity, fluency in English and highest level of education. This was followed by the question: "If you or someone you know had an ear infection, what search terms would you put into Google? Please list as many as you can think of." Recruitment was continued until no new key words were identified.

The top search terms retrieved from the participants were selected to be analysed in Google Trends (www.google.com/trends) and the following settings were applied: *worldwide* in the *past 12 month*s within *all categories* using *web search*. Google Trends was used to further refine the search terms and to gain insight on which search terms were the most commonly used.

2.3 Search Procedures

2.3.1 Locations

The English-speaking countries for the search were identified by collecting all countries that had a Google domain. This was achieved by using the *Advanced Search* section of Google Settings which provided a list of country-coded Top-Level Domains (ccTLD).

The inclusion criteria for the ccTLD in this study were: (1) if English was the predominant language and (2) if there were at least 2 million internet users. This was achieved by using information from the CIA World Factbook (Central Intelligence Agency, 2007) and Internet World Stats (2019) respectively. This gave a total of 21 countries and encompassed 97% of internet users in English-speaking countries. The country, locality, internet penetration rate and population of internet users for each country were collected (see Table 1). The locality of each country was derived using World Health Organisation regional offices (World Health Organisation, 2018). The internet penetration rate and population of internet users was retrieved from Internet World Stats (2019).

Table 1. English-speaking Countries with at least Two Million Internet Users.

Country	Locality	Internet Penetration Rate	Population of Internet Users
Kenya	Africa	83.0%	43,329,434
South Africa	Africa	53.7%	31,185,634
Tanzania	Africa	37.8%	23,000,000
Uganda	Africa	41.6%	19,000,000
Zimbabwe	Africa	39.3%	6,796,314
Cameroon	Africa	24.2%	6,128,422
United States	Americas	89.2%	292,892,868
Canada	Americas	92.7%	34,558,385
Puerto Rico	Americas	83.3%	3,047,311
United Kingdom	Europe	94.2%	63,061,419
Ireland	Europe	91.9%	4,453,436
India	South-East Asia	40.9%	560,000,000
Indonesia	South-East Asia	53.2%	143,260,000
Philippines	South-East Asia	62.0%	67,000,000
Malaysia	South-East Asia	80.1%	26,009,000
Australia	Western Pacific	87.8%	21,743,803
Hong Kong	Western Pacific	89.4%	6,698,252
Singapore	Western Pacific	84.5%	4,955,614
New Zealand	Western Pacific	88.1%	4,184,520
Total in study			**1,361,304,412**
Percentage in study			**97%**

2.3.2 Search and Selection of Webpages

The refined list of search terms was entered into each of the 21 ccTLDs using an advanced search in Google settings. The first 10 webpages that met the inclusion criteria and exclusion criteria were included. Ten search listings were used as research showed that individuals generally only look at the top Google results which defaults to 10 listings when searching for online health information (Eysenbach & Köhler, 2002). The inclusion criteria were as follows: (1) written in English, (2) contain information relating to OM, and (3) freely available to the public. Webpages were excluded if they were: (1) a Google-identified advert, (2) a directory listening, and (3) fewer than 100 words in length.

Once all duplicates were removed, G* Power was used to perform a sample size analysis to determine the minimum sample for each WHO region. A sample size of 18 was established as the minimum sample size required from each WHO region to sustain a normal distribution. A random number generator was used to select 18 webpages if the numbers of webpages in each region was greater than 18. This gave the final list of webpages.

The Uniform Resource Locator (URL), locality and type of organisation of each webpage were recorded in a Microsoft Excel document. The locality and type of organisation was determined by either the URL, information provided in the *About Us* section of the webpage or through further internet searching. The locality was coded by WHO region (Africa, Americas, Europe, South East Asia, Eastern Mediterranean, Western Pacific and World). This was done to ensure statistical analysis would be possible by achieving an even distribution of data. The type of organisation was classed as either non-profit, governmental or commercial. It was classed as 'non-profit' if the organisation could be verified as being non-profit. It was classed as 'governmental' if it was associated with a governmental agency and 'commercial' if the criteria for non-profit or government could not be applied.

2.4 Readability Analysis

Readability of each webpage was assessed using the following readability formulas: FOG, SMOG and F-K. This was obtained using a free online English readability tool (www.online-utility.org/english/readability_test_and_improve.jsp). The content of each webpage was accessed so that the entire text was available to be assessed using the readability tool. This involved expanding any collapsed body text below headings or subheadings. The content was copied and pasted into the readability tool. The readability scores obtained from each readability formula were entered into the Excel document and the mean RGL was calculated.

2.5 Quality Analysis

Quality of each webpage was determined by the presence or absence of the HONcode certification. HONcode certification was determined by inserting the website names into the HONsearch function on the HON website (https://www.hon.ch/HONsearch/Patients/index.html). The presence or absence of the HONcode certification was entered into the Excel document as either *yes* or *no*.

2.6 Content Analysis

2.6.1 Inter-rater Reliability

Content analysis of each webpage was evaluated using the following tools: DISCERN, PEMAT and Plain Language Checklist. Prior to carrying out the analysis, researchers investigating the content of online hearing-related information discussed the PEMAT and Plain Language Checklist by reviewing each of the questions together. The DISCERN was revised by a member of the research team. The PEMAT was revised so that the primary researcher and secondary researcher would agree between subjective interpretation of scoring. The Plain Language Checklist was revised by combining three

checklists: The Plain English Checklist for Documents (National Adult Literacy Agency, 2019), Quick Checklist for Plain Language (Center for Health Literacy, 2019), and the Checklist for Plain Language on the Web (Plain Language Action and Information Network, 2019).

A random generator was used to select 20% of webpages from each locality for the reliability check. These webpages were distributed amongst the research term as evenly as possible. The webpages were analysed using the assessment tools. The main measure of inter-rater reliability is the Intraclass Correlation (ICC). This is a measure of how consistent 2 or more raters are on a measure. The kappa generated from the ICC is used to determine how reliable the ratings are. Values of kappa range from 0 (no agreement between raters) and 1.0 (perfect agreement). Following this reliability check, the remaining webpages were analysed by the main researcher.

2.6.2 DISCERN

All 16 items of the DISCERN tool were rated for each webpage, unless any of them could not be applied. The overall quality rating (question 16) was recorded on the Excel document and used for the analysis.

2.6.3 PEMAT

PEMAT-P and PEMAT-A/V was used to score printable materials and audio-visual materials respectively. A total of 24 items were scored for printable materials and 17 items for audio-visual materials. Each item was scored as either ‘agree (1)’ or ‘disagree (0),’ and some items also had a ‘not applicable’ answer option. Each webpage produced two scores including one for understandability and one for actionability. The two percentage scores were recorded by summing the total points for either understandability and actionability divided by

total possible points, excluding the items that were scored as ‘not applicable,’ and then multiplying the result by 100.

2.6.4 Plain Language

A total of 20 items on the Plain Language Checklist was scored as either *yes* or *no* and the total number of *yes* and *no* responses were recorded for the webpage. The total number of *yes* and *no* responses for each item was also recorded.

2.7 Statistical Analysis

Statistical analysis was performed using IBM SPSS Version 24 software. The assumptions of normality and parametric testing were tested separately. The descriptive statistics included: Chi Square test, one sample t-test and analysis of variance (ANOVA). An alpha level of 0.05 was used to determine significance for all statistical analyses.

Chapter 3: Results

3.1 Overview

The purpose of this study was to investigate the readability, quality and content of online information on OM in English. This study also aimed to examine the influence of locality, type of organisation, and presence or absence of the HON code on the readability, quality and content of information.

The following search terms were identified as being the most commonly used: (1) ear infection, (2) ear infection symptoms, (3) ear infection signs, (4) ear pain, (5) sore ear, (6) ear infection in adults, and (7) ear infection treatment. The advanced search on Google settings was performed on the 7th of June 2019. This gave a total of 441 unique webpages that met the inclusion and exclusion criteria. An even distribution of webpages was randomly selected from each region to meet the minimum sample size required to perform statistical analysis. This gave the final list of 101 webpages.

3.2. Inter-rater Reliability

A random number generator was used to select 20% of webpages from each region for the reliability check. The webpages were analysed using the assessment tools by the research team. According to Fleiss (1981), values of kappa range from 0 (no agreement between raters) and 1.0 (perfect agreement). The ICC values obtained for the webpages on OM were as follows: Plain Language: ICC = .921, PEMAT Understandability: ICC = .882, PEMAT Actionability: ICC = .893 and DISCERN: ICC = .871. These can all be described as "excellent agreement beyond chance" (Fleiss, 1981, p. 218).

3.3 Descriptive Statistics

3.3.1 Locality

The locality for each webpage was recorded. These were from Africa (*n* = 15, 14.9%), Americas (*n* = 18, 17.8%), Europe (*n* = 18, 17.8%), South East Asia (*n* = 15, 14.9%), Western Pacific (*n* = 18, 17.8%) and World (*n* = 17, 16.8%).

3.3.2 Organisation

The type of organisation for each webpage was recorded. Most of them were commercial (*n* = 86, 85.1%) and the fewest were non-commercial (*n* = 15, 14.9%). Commercial was subdivided into further categories including Private (*n* = 27, 26.7%), News or Magazine (*n* = 21, 20.8%), Personal or blog (*n* = 16, 15.8%), National or Global Resource (*n* = 14, 13.9%), and Other (*n* = 8, 7.9%). Other consisted of retail, public health and journal articles. Non-commercial consisted of non-profit and government (*n* = 15, 14.9%).

3.3.3 HONcode Certification

There were only 6 webpages (5.9%) that had HONcode certification. Due to the lack of variability and small sample size, all hypotheses relating to HONcode certification were removed.

3.3.4 Readability

The RGL of the webpages using the FOG ranged from 7.40 to 18.99 (*M* = 11.68, *SD* = 2.18). The RGL of the webpages using the SMOG ranged from 8.37 to 16.35 (*M* = 11.55, *SD* = 1.51). The RGL of the webpages using F-K ranged from 5.65 to 16.32 (*M* = 9.44, *SD* = 1.96). The mean RGL of all the readability measures ranged from 7.39 to 17.22 (*M* = 10.89, *SD* = 1.87).

3.3.5 DISCERN

DISCERN scores ranged from 1 to 5 ($M = 2.61$, $SD = .80$). Table 2 provides the mean and standard deviations of DISCERN scores for each DISCERN item in descending order for each section, and the mean overall rating of the webpages.

Table 2. Mean DISCERN score for each Item in Descending Order.

Item No.	Item	Mean Score (SD)
Section 1: Reliability of the Publication		
1.	Clear aims	4.52 (0.74)
2.	Achieves its aims	4.38 (0.81)
3.	Relevance	3.74 (0.97)
4.	Date of sources used, revisions, and date of publication	3.48 (0.99)
5.	Balanced and unbiased	3.37 (0.96)
6.	Sources of information used (other than the author/producer)	2.40 (1.63)
7.	Additional sources of support and information	2.15 (1.66)
8.	Areas of uncertainty	1.29 (0.88)
Section 2: Quality of Information on Treatment Choices		
9.	How each treatment works	3.13 (1.46)
10.	More than one possible treatment choice	2.84 (1.37)
11.	What would happen if no treatment used	2.75 (1.66)
12.	Benefits of each treatment	2.70 (1.44)
13.	Risks of each treatment	1.90 (1.32)
14.	Support for shared decision-making	1.63 (1.21)
15.	How each treatment choice affects quality of life	1.10 (0.46)
Section 3: Overall Rating of the Publication		
16.	Overall Quality	2.61 (0.80)

3.3.6 PEMAT

PEMAT scores ranged from 50 to 100 (*M* = 80.29, *SD* = 9.59). Understandability scores ranged from 56.26 to 100 (*M* = 82.41, *SD* = 9.98) and actionability scores ranged from 0 to 100 (*M* = 72.67, *SD* = 19.33). Table 3 provides the percentage of webpages that obtained an 'agree' score for each PEMAT item.

Table 3. Percentage of Webpages for each PEMAT Item. (N= Number of webpages excluding not applicable).

Item Number	**Item**	**Agree (%)**
Understandability		
Topic: Content		
1.	Evidence of purpose • (*N*= 101)	98
2.	No information or content that distracts from its purpose * (*N*= 101)	99
Topic: Word Choice and Style		
3.	Common, everyday language • (*N*= 101)	51
4.	Medical terms used to familiarize audience with the terms. When used, terms are defined • (*N*= 101)	53
5.	Active voice • (*N*= 101)	99
Topic: Use of Numbers		
6.	Numbers are clear and easy to understand * (*N*= 77)	99
7.	No expectation of the user to perform calculations * (*N*= 101)	100
Topic: Organisation		
8.	Information is broken into short sections • (*N*= 101)	100
9.	Informative headers • (*N*= 101)	97
10.	Logical sequence •*N*= 101)	99
11.	Summary • (*N*= 101)	24

Topic: Layout and Design		
12.	Visual cues • (*N*= 101)	93
13.	Text on screen is easy to read ° (*N*= 101)	100
14.	User can hear the words clearly ° (*N*= 9)	100
Topic: Use of Visual Aids		
15.	Visual aids to make content more easily understood * (*N*= 101)	44
16.	Visual aids reinforce rather than distract from the content * (*N*= 62)	92
17.	Visual aids have clear titles or captions * (*N*= 62)	61
18.	Visual aids are clear and uncluttered • (*N*= 62)	98
19.	Simple tables • (*N*= 3)	67
Actionability		
20.	At least one action is identified • (*N*= 101)	94
21.	Addresses the user directly when describing actions • (*N*= 101)	75
22.	Any action is broken into manageable, explicit steps • (*N*= 101)	94
23.	Tangible tool whenever it could help the user take action * (*N*= 101)	95
24.	Explanation of how to use charts, graphs, tables, or diagrams to take actions • (*N*= 1)	0
25.	Visual aids whenever they could make it easier to act on the instructions * (*N*= 101)	6

** = Print, ° = Audio-visual, • = Print and audio-visual*

3.3.7 Plain Language

Plain language scores ranged from 12 to 20 (*M* = 17.65, *SD* = 1.91). Table 4 provides a summary of the percentage of webpages that obtained a 'yes' score for each plain language factor in descending order for each topic.

Table 4. Percentage of Webpages that Included Each Plain Language Factor in Descending Order (N = 101).

Plain Language Factor	**Percentage of Webpages (%)**
Topic: Reader Focus	
Relevance of content	99
Headings containing topic of interest	97
Introduction informing reader what they are about to read	95
Topic: Organisation	
Most important message at the beginning of the material	98
Sensible order	98
Different topics under separate headings/subheadings	96
Topic: Writing	
Active voice	100
Elimination of unnecessary words	96
Simple sentences	95
Correct punctuation	87
Correct grammar	81
Personal pronouns	73
Lay terms	48
Technical terms are explained	46
Topic: Design and Formatting	
Visually easy to read	100
Clean font	100
Large text size	100
Italics, underlining, capitalisation, and bold print used sparingly	100
Appearance of the material consistent throughout	99
Images are clear, uncluttered and related to content	56

3.3.8 Summary of Descriptive Results

Table 5 provides the mean and standard deviations of readability, DISCERN, PEMAT and plain language scores based on webpage locality. Table 6 provides the mean and standard deviations of scores based on type of organisation.

Table 5. Mean and Standard Deviations (M, SD) of Mean RGL, Plain Language, DISCERN and PEMAT Scores based on Web Page Locality.

Location	Mean RGL	DISCERN	PEMAT	Plain Language
Africa	10.92 (2.21)	2.27 (0.80)	79.65 (11.25)	16.93 (2.89)
Americas	11.02 (1.48)	2.61 (0.70)	82.78 (7.02)	18.22 (1.31)
Europe	10.71 (1.70)	2.56 (0.92)	80.11 (9.51)	17.61 (1.94)
South East Asia	10.27 (1.45)	2.53 (0.64)	79.93 (10.09)	17.73 (1.10)
Western Pacific	11.08 (2.01)	2.72 (0.67)	80.47 (8.30)	18.17 (1.62)
World	11.25 (2.32)	2.94 (0.97)	78.53 (11.93)	17.12 (2.06)

Table 6. Mean and Standard Deviations (M, SD) of Mean RGL, Plain Language, DISCERN and PEMAT Scores based on Type of Organisation.

Organisation	Mean RGL	DISCERN	PEMAT	Plain Language
Personal/Blog	10.87 (1.44)	2.56 (0.63)	78.24 (8.70)	17.25 (1.69)
News/Magazine	10.78 (1.93)	2.48 (0.68)	79.98 (9.78)	17.71 (2.19)
Private	10.66 (1.94)	2.41 (0.64)	80.85 (8.77)	17.48 (2.03)
National or Global Resource	11.30 (1.82)	3.14 (0.95)	81.39 (10.70)	18.21 (1.85)
Other	11.28 (1.98)	2.13 (0.99)	76.31 (14.59)	17.25 (2.19)
Non-Commercial	10.88 (2.21)	3.00 (0.85)	82.99 (7.73)	18.00 (1.41)

3.4 Hypotheses Testing

3.4.1 Normality

Given the large sample size ($N = 101$), normal distribution was assumed. However, the data were examined for skewness, kurtosis, significant outliers, and homogeneity of variance. With the one exception described in Section 3.4.7, the data were determined to meet the assumptions of parametric testing.

3.4.2 Distribution based on Locality and Type of Organisation

1. Is there an even distribution of OM-related online information based on localities?
2. Is there an even distribution of OM-related online information based on types of organisation?

A chi-square test of goodness of fit was performed to analyse the distribution of OM-related online information based on different localities. There was an even distribution based on locality, χ^2 (5, $N = 101$) = 0.64, $p = .99$. A chi-square goodness of fit was performed to examine the distribution of information based on types of organisations. There was an uneven distribution based on types of organisations, χ^2 (5, $N = 101$) = 12.53, $p = .028$.

These results show that the null hypotheses (1) there is an even distribution of OM-related online information based on localities was supported, and (2) there is an even distribution of OM-related online information based on types of organisation was not supported.

3.4.3 Distribution Within Locality and Type of Organisation

1. Within locality, is there an even distribution of OM-related online information based on types of organisation?

A chi-square test of independence was performed to analyse the distribution between locality and type of organisation. The assumptions of a chi-square test of independence was violated as 36 cells had expected counts less than 5. The following null hypothesis (1) within locality, there is an even distribution of OM-related online information based on types of organisation was removed.

3.4.4 Comparison of Readability to the Recommended Sixth RGL

1. Is there a significant difference in the mean RGL of OM-related online information from the recommended sixth RGL?

A one-sample t-test was performed to analyse the difference in the mean RGL of OM-related online information from the recommended 6th RGL. The mean RGL was significantly higher than the recommended 6th RGL, $t(100) = 26.33$, $p < .001$. The following null hypotheses (1) there is no significant difference in the mean RGL of OM-related online information from the recommended 6th RGL was not supported.

3.4.5 Readability Based on Locality and Type of Organisation

1. Are there significant differences in the mean RGL of OM-related online information based on different localities?
2. Are there significant differences in the mean RGL of OM-related online information based on types of organisations?

A two-way ANOVA was performed to analyse the influence of locality and type of organisation on the mean RGL. The Levene's test indicated unequal variances. Therefore, a one-way ANOVA was performed for each of the independent variables separately. There was

no significant difference in the mean RGL based on locality, $F(5, 95) = .530$, $p = .753$, $\eta_p^2 = .027$. There was no significant difference in the mean RGL based on type of organisation, $F(5, 95) = .291$, $p = .917$, $\eta_p^2 = .015$.

These results show that the null hypotheses (1) there is no significant difference in the mean RGL of OM-related online information based on locality was supported, and (2) there is no significant difference in the mean RGL of OM-related online information based on type of organisation was supported.

3.4.6 Quality Based on Locality and Type of Organisation

1. Are there significant differences in the DISCERN scores of OM-related online information based on different localities?
2. Are there significant differences in the DISCERN scores of OM-related online information based on types of organisations?

A two-way ANOVA was performed to analyse the influence of locality and type of organisation on the DISCERN scores. The Levene's test indicated unequal variances. Therefore, a one-way ANOVA was performed for each of the independent variables separately. There was no significant difference in the DISCERN scores based on locality, $F(5, 95) = 1.268$, $p = .284$, $\eta_p^2 = .063$. There was a significant difference in the DISCERN scores based on type of organisation, $F(5, 95) = 3.380$, $p = .007$, $\eta_p^2 = .151$. Post-hoc testing was performed whereby there was a significant mean difference in the DISCERN scores between 'National or Global resource' and 'Other' of 1.02 and the p-level was .046.

These results show that the null hypotheses (1) there is no significant difference in the DISCERN scores of OM-related online information based on locality was supported, and (2) there is no significant difference in the DISCERN scores of OM-related online information based on type of organisation were not supported.

3.4.7 Content Analysis Based on Locality and Type of Organisation

3.4.7.1 PEMAT Based on Locality and Type of Organisation

1. Are there significant differences in the PEMAT scores of OM-related online information based on different localities?
2. Are there significant differences in the PEMAT scores of OM-related online information based on types of organisations?

The PEMAT subscales were combined as the distribution was significantly skewed and kurtotic when analysing the subscales separately. Following this, the data met the assumptions of parametric testing. A two-way ANOVA was performed out to analyse the influence of locality and type of organisation on the PEMAT. The Levene's test indicated unequal variances. Therefore, a one-way ANOVA was carried out for each of the independent variables separately. There was no significant difference in the PEMAT scores based on locality $F(5, 95) = .366$, $p = .871$, $\eta_p^2 = .019$. There was no significant difference in the PEMAT scores based on type of organisation $F(5, 95) = .710$, $p = .617$, $\eta_p^2 = .617$.

These results show that the null hypotheses (1) there is no significant difference in the PEMAT scores of OM-related online information based on locality was supported, and (2) there is no significant difference in the PEMAT scores of OM-related online information based on type of organisation was supported.

3.4.7.2 Plain Language Based on Locality and Type of Organisation

1. Are there significant differences in the plain language scores of OM-related online information based on different localities?
2. Are there significant differences in the plain language scores of OM-related online information based on types of organisations?

A two-way ANOVA was performed to analyse the influence of locality and type of organisation on the plain language scores. The Levene's test indicated unequal variances. Therefore, a one-way ANOVA was performed for each of the independent variables separately. A one-way ANOVA was performed for locality. This showed a significant Levene's test. Thus, a Games Howell post-hoc test was carried out to account for unequal variances. There was no significant difference in the plain language scores based on locality, $F(5, 95) = 1.307$, $p = .268$, $\eta_p^2 = .064$. A one-way ANOVA was performed for type of organisation. There was no significant difference in the plain language scores based on type of organisation, $F(5, 95) = .593$, $p = .705$, $\eta_p^2 = .030$.

These results show that the null hypotheses (1) there is no significant difference in the plain language scores of OM related online information based on locality was supported, and (2) there is no significant difference in the plain language scores of OM related online information based on type of organisation was supported.

3.5 Summary

Parametric statistical analysis was used as all assumptions of parametric testing were met. All hypotheses examining the HON code were removed from hypotheses testing as there was an uneven distribution of webpages with and without the HON code. The hypothesis regarding the distribution within locality and type of organisation was also removed as it violated the assumptions of a chi-square test of independence. Overall, it was found that all null hypotheses were supported except for three hypotheses: (1) there is an even distribution of OM related online information based on types of organisation, (2) there is no significant difference in the mean RGL of OM related online information from the recommended sixth RGL, and (3) there is no significant difference in the DISCERN scores of OM related online information based on type of organisation.

Chapter 4: Discussion

4.1 Overview

The purpose of this study was to assess the readability, quality, and content of OM-related online information in English. The findings showed that the mean readability of OM-related online information was high. The mean DISCERN score indicated below-moderate quality. The mean PEMAT scores were rated as being adequately understandable and actionable, and the use of plain language was reasonable.

This study also analysed the influence of locality, types of organisation, and presence or absence of the HON code on readability, quality and content of information. There was an even distribution of webpages based on locality and an uneven distribution based on types of organisation. Readability, PEMAT and use of plain language were similar across localities and types of organisation. Similarly, there was no significant difference in DISCERN scores of webpages based on locality. However, there was a significant difference in DISCERN scores based on types of organisation.

This chapter will discuss the readability, quality, and content of OM-related online information in relation to previous studies. Furthermore, it will identify the main strengths and weaknesses across the different areas of each assessment tool and provide recommendations on ways to improve OM-related information. Additionally, it will discuss in detail the broader implications, study limitations and suggestions for future research in this area.

4.2 Distribution of OM-related online information

The results showed an even distribution of OM-related online information based on localities. This was expected as an even number of webpages from each WHO region was selected to meet the minimum sample size required to sustain a normal distribution. There was an uneven distribution of information based on the types of organisation. Most of the webpages (85.1%) assessed were of commercial origin. Commercial was subdivided into categories including Private, News or Magazine, Personal or Blog, National or Global Resource, and Other. Non-commercial consisted of non-profit and government organisations.

Webpages from a 'Private' origin including businesses and clinics dominated. In contrast, webpages from 'Other' including retail, public health and journal articles were the least represented. This finding was consistent with a study carried out by McKearney and McKearney (2013) which found that 89% of the webpages on grommets were of commercial origin. Laplante-Lévesque et al. (2012) and Manchaiah et al. (2019) also found that most webpages were of commercial origin for online information for adults with HL and tinnitus respectively. It is likely that the high incidence of OM, particularly in children led to a plethora of commercially based webpages. In many cases, these webpages were not necessarily trying to advertise a product or business as most of the treatment regarding OM requires analgesics or medical help. These commercial webpages were often purely informing readers on common medical pathologies.

Other studies looking at OM-related information incorporated different inclusion and exclusion criteria (Goslin & Elhassan, 2013; Joury et al., 2018). This included removing websites such as news webpages, videos, academic journals or those targeting health care professionals. Health information seekers encounter information from many sources which are of varying quality, accuracy, and reliability (Fergie, Hunt, & Hilton, 2013). Eysenbach and Kohler (2002) found that approximately 23% of individuals could recall the category the webpage owner belonged to. This suggests that although they use these sources to answer

their health questions, they are unlikely to pay attention to the origin of the information (Eysenbach & Kohler, 2002). Thus, it is important to include webpages that are widely accessible to the public, regardless of their origin. Furthermore, webpages from official authorities, professional bodies, and citation of scientific references are the most trusted sources of online health information (Eysenbach & Kohler, 2002). This includes webpages targeting health care professionals and academic journals. Therefore, it is likely that individuals are accessing webpages that had been excluded in previous studies of OM-related online information.

4.3 Readability of OM-related online information

The results showed that the mean RGL of all the readability measures was above the recommended sixth RGL for all the webpages. Even the webpage with the lowest mean RGL was difficult to read. The mean RGL of the webpages using the F-K was 9.44. Other studies looking at OM-related information assessed readability using the FRE score and the F-K formula. Joury et al. (2018) found that the mean FRE score was 52.2 and the F-K level was 9.9 for information on OM and middle ear infection. McKearney and McKearney (2013) also found that the mean FRE score was 49.4 and the F-K level was 10.1 for information on grommets. Studies that looked at information using the key words 'AOM,' 'glue ear,' 'microtia,' and 'aural atresia' all reported consistent findings indicating that OM-related information is difficult to read and written at a reading level of a 10^{th} grade school pupil. Furthermore, these findings supported studies that were not just limited to OM (Atcherson et al., 2014; Daraz et al., 2018; Eloy et al., 2012; Joubert & Githinji, 2014; Laplante-Lévesque et al., 2012; Manchaiah et al., 2019).

The mean RGL of 11.68 and 11.55 using the FOG and SMOG, respectively indicate that that the materials are written much higher than the recommended sixth RGL. Although the mean RGL of OM-related information has not been reported in previous literature using

the FOG and SMOG, it is a valid formula to use, particularly in the context of expected comprehension (Wang et al., 2013). It is not ideal to be determining RGL from formulas that employ expected comprehension levels less than 100%. Although both the FRE and F-K formulas are the most commonly used, both estimate to 75% on a multiple-choice test and 35% on a cloze test (Wang et al., 2013). In comparison, the FOG and SMOG estimate to 90% and 100% on a multiple-choice test, respectively (Wang et al., 2013). Thus, it may be more appropriate to use a conservative formula, particularly for health care applications.

There were no significant differences in the mean RGL of webpages based on locality and type of organisation. The mean RGL across the localities and type of organisation all exceeded the recommended 6th RGL. Laplante-Lévesque et al. (2012), Manchaiah et al. (2019), and Potter (2015) found similar results indicating poor readability of hearing-related and tinnitus information independent of the type of organisation. On the contrary, Fitzsimmons, Michael, Hulley, and Scott (2010) and Johnson (2017) found that commercial webpages had lower readability than webpages from a non-profit or government origin respectively.

Evidently, any factor that affects an individual's understanding of health information will have the potential to negatively affect health behaviours (Daraz et al., 2018). Adequate readability is a key requirement of establishing a knowledge base on their health condition (Daraz et al., 2018). This improves health outcomes, SDM, patient autonomy, quality of life and reduces health care costs (Daraz et al., 2018). Ensuring low readability of OM-related information is particularly important as patients will search the internet when symptoms appear to decide what management options to take (Joury et al., 2018). Poor readability is likely to confuse and frustrate patients, particularly parents of children who turn to the internet for additional information (Pothier, 2005). This issue is exacerbated even more so due to the widespread presence of low health literacy (Kutner et al., 2006; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005). Individuals will low health literacy

are less likely to recognise the first signs of medical problems, navigate health care systems, understand information, and actively manage their condition (Berkman et al., 2011; Diviani et al., 2015). Thus, low RGLs improves self-efficacy such that individuals engage in strategies that help them make informed health decisions (Meade & Smith, 1991).

4.4 OM-related online information Using the DISCERN

The range of DISCERN scores of all the webpages was 1 to 5 with a mean score of 2.61. This was the mean of the overall rating at the end of the DISCERN tool based on a subjective rating of the quality of the publication regarding treatment choices. This corresponds to a 'below-moderate' rating whereby the webpages may have potentially important shortcomings (Charnock et al., 1999). A poor understanding of treatment choices can have a detrimental effect on health outcomes, independent of participation in the decision-making process (Blanchard, Labrecque, Ruckdeschel, & Blanchard, 1988). This is particularly important in the cases of OM, whereby understanding the triage of symptoms and associated management plans is a key factor in establishing what the condition is and preventing further episodes.

There was a large range in DISCERN scores that were reported in literature relating to OM information. Joury et al. (2018) found that the DISCERN scores for webpages using the keywords 'OM' and 'middle ear infection' ranged from 20 - 69 out of 80, with a mean DISCERN score of 47. Ritchie et al. (2016) reported a range of 26 - 75 out of 80, with a mean DISCERN score of 57 for information on 'glue ear.' McKearney and McKearney (2013) reported a range of 18 - 64 out of 80, with a mean DISCERN score of 38.5 for information on 'grommets.' These studies reported the DISCERN differently, by adding the ratings of each question on a scale of either 1 'no', 2 to 4 being 'partial,' and 5 being 'yes.' The total score (maximum 80) was reported instead of the overall quality rating reported in this study. Nevertheless, these results show that there is a significant range in the quality of

information that is accessible to the public, most of which is of 'fair' quality. Furthermore, no webpage obtained a full score in previous studies, suggesting that all the content that has been assessed thus far lacks high quality information.

This finding is consistent with other studies investigating hearing-related information. Laplante-Lévesque et al. (2012) reported a mean DISCERN score of 2.04 for information directed towards individuals with HL and their significant others. Similarly, Manchaiah et al. (2019) reported a mean DISCERN score of 2.39, regarding tinnitus-related information. In the cases of OM and many other illnesses, feelings of anxiety and uncertainty lead individuals to search the internet to decide whether to seek a health professional (Meherali et al., 2019). For some individuals, the internet is often their first source of advice (Hesse, Moser, & Rutten, 2010). Thus, it is imperative that the information that they are exposed to is accurate, unbiased, and complete (Cline & Haynes, 2001).

There were no significant differences in DISCERN scores based on locality. However, there were significant differences in mean DISCERN scores based on the type of organisation. The mean DISCERN score for webpages that were of a national or global resource were significantly higher than those that were in the other (retail, public health and journal articles) category. In general, national or global resources were mainly companies founded by healthcare professionals and industry experts. These companies were well established with a significant user-based system. Therefore, the content of the information was likely to be evidence-based, unbiased and up-to-date. Those webpages in the other category were mainly retail companies such as pharmacies that were providing a quick factsheet of superficial information regarding OM. Most of these webpages lacked evidence-based information on the risks of treatment including postponing treatment or permanently forgoing treatment.

As these two categories were both of commercial origin, it is difficult to compare these findings with other studies that make comparisons between commercial, government,

and non-profit organisations. However, many studies have reported findings that suggest that DISCERN scores can often be lower for webpages of a commercial origin (Dueppen, Bellon-Harn, Radhakrishnan, & Manchaiah, 2019; Janssen, Fahlbusch, Kasmann, Rades, & Vordermark, 2019; Laplante-Lévesque et al., 2012; Strathdee-Goomes, 2019.; Yoon et al., 2019).

4.4.1 Strengths Identified by DISCERN

The mean DISCERN scores for each item ranged from 1.10 to 4.52. This suggests that there all areas of the DISCERN require improvement. The strengths that were identified by the DISCERN were associated with addressing the reliability of the publication. These included the following items:

1. Clear aims,
2. Achieves its aims,
3. Relevance,
4. Date of sources used, revisions, and date of publication,
5. Balanced and unbiased.

This finding was consistent with another study by Joury et al. (2018) looking at the quality of OM-related information. Most of the webpages outlined the definition of OM clearly and made realistic recommendations in an objective manner. The different types of OM, symptoms and management options associated with each type were clearly discussed. The most common recommendation was for readers to seek a health professional to receive medication, antibiotics or grommets. Many webpages also included preventative measures to help individuals avoid future infections.

The prevalence of OM in children meant that webpages were specifically designed in a way that was often targeted towards parents and caregivers. This included using information media such as blog posts, news articles, videos, and forums to address relevant

questions that parents may ask. Some webpages included personal stories about parents' experiences with children with OM. Readers are less likely to gravitate towards desirable behaviours when information centres around facts, particularly if they have low health literacy (Doak, Doak, & Root, 1996). Thus, using personal stories were a successful method of promoting understanding as this made the information relatable to readers.

4.4.2 Weaknesses Identified by DISCERN

The weaknesses identified by the DISCERN included the following items:

6. Sources of information used,
7. Additional sources of support and information,
8. Areas of uncertainty,
13. Risks of treatment,
14. Support for SDM,
15. How treatment choice affects quality of life.

References to evidence-based sources and discussions around the differences in opinions concerning treatment choices was often overlooked. For example, although there are specific management options for OM, the guidelines that healthcare professionals follow regarding antibiotic usage can vary. Antibiotics are not routinely prescribed in the treatment of uncomplicated AOM, due to development of antibiotic resistance (Qureishi et al., 2014b). Therefore, antibiotic treatment is commonly considered in younger children, those that have bilateral AOM, systemic symptoms including fever, and those that have not improved following 48 hours of watchful waiting (Lieberthal et al., 2013). The criteria around antibiotic usage was often not included. This is concerning as some webpages implied that antibiotics would be provided regardless of the stage of infection. Those webpages that described under what circumstances the treatment would be prescribed obtained higher DISCERN scores than those that lacked additional information.

Although the benefits of each treatment were often described, many of the webpages lacked information on the risks of treatment. Joury et al. (2018) also found that the risks of treatment were absent in OM-related information. All treatment itself carries risks that individuals should be aware of (Goslin & Elhassan, 2013). Good quality health information helps readers consider all aspects of a treatment choice (Charnock et al., 1999). Very few webpages mentioned the risks of OM treatment such as the surgical risks, antibiotic resistance as well as the ototoxicity of antibiotics (Mittal et al., 2015). Even if there is a clear course of action and the risks of treatment are low, quality information allows readers to consider each aspect of treatment so that expectations are met (Meherali et al., 2019).

Additional sources of information, and support for SDM was also lacking. Individuals often use the internet alongside information provided by healthcare professionals (Fox & Rainie, 2002). Healthcare professionals remain as the primary information source and most trusted source for patients (Fox & Rainie, 2002). Therefore, it is beneficial for online information to make suggestions of what to discuss with family, friends or healthcare professionals (Charnock et al., 1999). This is likely to encourage patient involvement and translate to efficacious behaviours (Bae, 2017; Hughes et al., 2018).

4.5 OM-related online information Using the PEMAT

The PEMAT scores ranged from 50 to 100 with a mean PEMAT score of 80.29. This involved the combination of two separate scores including one for understandability and one for actionability (Shoemaker et al., 2014). The mean understandability and actionability score were 82.41 and 72.67, respectively. Both scores met the criteria of ≥ 70%, which is the minimum score recommended by Shoemaker et al. (2014) to achieve adequate reader comprehension.

The findings of this study showed variable results compared to other studies assessing health information using the PEMAT tool. The mean PEMAT score was much higher than

patient education materials on diabetes care (58.5%) (Kang & Lee, 2019) and vocal cord paralysis (53%) (Balakrishnan et al., 2016). Wong, Gilad, Cohen, Kirke, and Jalisi (2017) found that the mean understandability and actionability score was 68.5 and 65.9, respectively for laryngectomy information, both of which do not meet the minimum score of 70%. There were no significant differences in PEMAT scores based on locality and type of organisation. In contrast, Lipari, Berlie, Saleh, Hang, and Moser (2019) found that the scores from pharmaceutical companies were higher compared with scores of non-profit organisations. Although it was not a significant result in this study, non-commercial organisations including government and non-profit organisations had the highest scores. While the PEMAT has not been reported in other studies investigating OM-related information, the findings of this study show that the information is largely understandable and actionable which is promising.

4.5.1 Strengths Identified by PEMAT

The main strengths identified by the PEMAT tool included the following items:

1. Content,
2. Word choice,
3. Use of numbers,
4. Organisation,
5. Layout and design,
6. Use of visual aids relevant to the topic.

Readers should know what the material is going to cover and who the target audience is at the beginning of a publication. The introduction is often the deciding factor of whether an individual decides to pursue their reading. In general, topics were outlined and the target of audience was established. This was often followed by the use of personal pronouns to directly address the reader.

Organisation, layout and design has a considerable impact on the understandability of information. Individuals with low health literacy often have limited skills to effectively navigate health care systems (Diviani et al., 2015). Thus, information should be presented in a logical sequence to assist the reader. All the material was broken into short sections. Many of the webpages described the definition of OM, symptoms, causes, diagnosis and treatment in separate sections. Chunking is an important feature of information that mediates the amount of knowledge that an individual can process at any one time (Miller, 1956). It allows individuals to retain and recall key messages that are relevant to the reader (Ericcson, Chase, & Faloon, 1980). Another strength identified by the PEMAT was the clarity of words presented in the videos. Aspects of speech such as the pace and pronunciation affect the clarity of speech (Turk & Shattuck-Hufnagel, 2014). Poor clarity can easily confuse listeners and affect intelligibility. All 9 videos that were analysed in this study contained information that was easy to listen to and understand.

Patient education materials are considered actionable when readers can recognise what steps to take based on the information provided to them (Shoemaker et al., 2014). In many cases of OM, infection resolves without requiring treatment (Qureishi et al., 2014b). However, treatment is necessary if the symptoms are severe or if the infection is persistent (Qureishi et al., 2014b). Most of the information was clear at mentioning when it may be important to see a medical professional. It encouraged individuals to relieve the pain using analgesics and other methods before consulting a clinician, particularly if it was an acute infection. Furthermore, instructions were provided with consistent use of active voice. This was an effective method of enabling readers to engage with the information and become active collaborators of their own care.

4.5.2 Weaknesses Identified by PEMAT

The main weaknesses identified by the PEMAT included the following items:

1. Lack of common, everyday language,
2. Definition of medical terms,
3. Summaries,
4. Visual aids that make content more easily understood,
5. Visual aids that could make it easier to act on instructions.

Only 24% of the webpages included a summary or review. Only half of the information defined medical terms (53%) and used common, everyday language (51%). In many cases, medical terms were included but not clearly defined. For example, words such as 'middle ear,' and 'ENT,' were not explained. Communication is only effective when information is understood by the reader. Individuals with limited health literacy struggle to comprehend information containing unfamiliar vocabulary or concepts (Davis, Williams, Marin, Parker, & Glass, 2002). They are less likely to admit they have difficulty understanding information or ask for clarification (Parikh, Parker, Nurss, Baker, & Williams, 1996). Using common terms, and a more informal tone will aim to enhance users' engagement and comprehension (Stableford & Mettger, 2007).

The use of visual aids is another method of enhancing communication. When used correctly, it can often surpass language and numeracy barriers (Pratt & Searles, 2017). However, in 44% of cases, visual aids did not make the content more easily understood. This included having pictures of ears with no labels or pictures of children that did not supplement the information. Examples of visual aids that were beneficial included diagrams of where OM occurs in relation to the ear, diagrams of grommets, or pictures of children expressing discomfort. As shown in Table 3, items 24. (Explanation of how to use charts, graphs, tables, or diagrams to take actions), and 25. (Visual aids whenever they could make it easier to act on the instructions) obtained the lowest actionability scores of 0% and 6% respectively.

Although these scores were low, the actions described in the webpages were relatively self-explanatory meaning that visual aids would not have added any significant value to the information.

4.6 OM-related online information Using Plain Language

As with the other factors that have been assessed in this study, plain language is another key aspect of health information that addresses the challenges of low health literacy (Stableford & Mettger, 2007). Although the use of plain language has been widely advocated for, it is yet to be an accepted health-industry standard (Stableford & Mettger, 2007). Moreover, the use of plain language in health information has been sparsely investigated.

Plain language scores ranged from 12 to 20 with a mean score of 17.65. Most of the webpages used simple active-voiced sentences that was designed appropriately. There were no significant differences in plain language scores based on the locality and type of organisation. Although it was not a significant result, plain language scores were highest in Western Pacific localities, and those of national or global resource origin. This may have been because the webpages were mainly health sectors working on a larger population scale to provide updated information on health topics. Thus, these organisations may have been more aware of the need to create information that bridges the communication gap between health care professionals and the public.

4.6.1 Strengths Identified by Plain Language Checklist

Many of the items in the plain language checklist were covered in other tools. Almost all the webpages had relevant information (99%), headings contained the topic of interest (97%), and the introduction informed the reader what they were about to read (95%). Information was reader focused, direct, and informative. Most of the webpages were organised in a logical manner (98%) with the most important message at the beginning of the

material. Topics were arranged in separate headings (96%) making it easier to extract relevant information within each section. All the webpages were visually easy to read, with clean font and large text size. Although there was a lot of information on each webpage, all webpages incorporated features such as italics, underlining, capitalisation, and bold print. The use of typography was an effective method of drawing the reader's attention to important medical terms or key messages.

4.6.2 Weaknesses Identified by Plain Language Checklist

Only 48% of the webpages used lay terms and 46% of the technical terms were explained. These results were synonymous with the PEMAT results regarding the use of common, everyday terms (51%) and medical terms explained (53%). Inappropriate use of technical terms is a major concern, as readers who are not experienced with the topic are likely to not understand it (Fage-Butler & Nisbeth Jensen, 2016). It has been shown that even different terminology given for the same condition influences individual perceptions of management options (Nickel, Barratt, Copp, Moynihan, & McCaffery, 2017). Although the main medical terms that were used in the webpages were defined, there were still terms in half of the webpages that were not clearly described. Even individuals with adequate literacy can have difficulty understanding medical terms used in the health care environment (Graham & Brookey, 2008). It is important that assumptions are not made by health professionals and webpage developers regarding both written and verbal information.

4.7 Clinical Implications

OM is one of the most common paediatric diagnoses following URTIs (Danishyar & Ashurst, 2019). The use of the internet is becoming increasingly more common (Couper et al., 2010). Thus, it is likely that individuals, particularly parents and caregivers will use the internet to search for medical advice for their child (Meherali et al., 2019). The most important information to understand about OM, is the ability to recognise the symptoms and to know what actions to take. However, at the time of a child's illness, management decisions may be less straightforward due to the overwhelming amount of online information. Thus, clear information on the different treatment options, and the benefits and risks associated with each treatment is necessary to understand. Ongoing episodes and the rare complications associated with OM can also be preventable (Qureishi et al., 2014b). Thus, education on the modifiable risk factors and preventative measures are important for reducing the propensity of infection. Online OM-related information has the potential to successfully inform all individuals regardless of their health literacy levels. However, it will only be beneficial to readers if the information is readable and of high quality. There is still a significant number of improvements that need to be made to facilitate the understandability of information. Section 4.7.1 provides recommendations on how to improve the content of OM-related online information. These recommendations are derived from the findings of this study.

4.7.1 Recommendations on How to Improve OM-related online information

4.7.1.1 Quality of OM-related online information

Table 7 provides recommendations for improving the quality of OM-related online information to achieve a '5' rating.

Table 7. Recommendations for Improving the Quality of OM-related Online Information.

Item	**Recommendation**
Reliability of the Publication	
Clear aims	Explicitly state the aim at the beginning of the publication. Include what topics will be discussed e.g. symptoms, causes, diagnosis, and treatment. It is also important to include topics that will not be covered so that readers know to seek additional information before making a treatment decision.
Achieves it aims	Focus on describing the symptoms of different types of OM, treatment and preventative measures rather than in-depth information on the pathophysiology and rare complications of OM.
Relevance	Focus on the frequently asked questions of treating and managing OM e.g. why is it prevalent in children, how it might affect children and when to seek help from a medical professional.
When the information was produced	Clearly state the date of publication and relevant revisions.
Balanced and unbiased	Focus on describing when each treatment choice might be relevant for an individual. Support claims with evidence-based information. Personal stories should inform readers that it may not be entirely relevant for their situation.
Sources of information	Support main claims with evidence-based information. Provide a bibliography with direct links to the references.

Additional sources of support and information	Provide additional sources with direct links to references or contact information of professionals that provide support.
Areas of uncertainty	Include information on emerging research on prevention of OM e.g. vaccinations and genetic factors.
Quality of Information on Treatment Choices	
How each treatment works	Describe how antibiotics and analgesics help treat short-terms symptoms of OM and describe how grommets work. Pictures of the placement of grommets in the ear can promote understanding.
More than one possible choice	Describe who and under what circumstances someone may benefit from each treatment. For example, antibiotics are not routinely prescribed unless they are young, have persistent infections or are at risk of developing complications.
No treatment	Describe the benefits and risks of watchful waiting or permanently forgoing treatment e.g. risk of persistent ear infections, HL and other complications.
Benefits of treatment	Provide both short term and long term benefits of treatment.
Risks of treatment	Provide short term and long term risks of treatment even if it is low risk.
Shared decision-making	Clearly state that all medical conditions are case-based. It should encourage readers to discuss their situation with other family or health professionals.
Quality of life	Describe how treatment may affect daily routines, activities or relationships with significant others e.g. improved speech and language development, expressive or receptive behaviour, participation at day-care.

4.7.1.2 PEMAT of OM-related online information

Table 8 provides recommendations for improving the understandability and actionability of OM-related online information.

Table 8. Recommendations for Improving PEMAT scores of OM-related Online Information.

Item	**Recommendation**
Understandability	
Content	Clearly state the purpose of the publication and focus information on desirable behaviours about managing and preventing OM.
Word Choice and Style	Medical jargon should be defined using common terms and diagrams to promote understanding e.g. define 'otitis media' and what the 'middle ear' is.
Use of Numbers	Numbers should be easy to understand. Statistics should be accompanied with references to support the information.
Organisation	Separate information into relevant headings. Information, including summaries should be in bullet point format with no more than five items within each heading.
Layout and Design	Use white space to reduce clutter and use visual cues to reinforce important information.
Visual Aids	Visual aids should supplement the information so that the content is more easily understood. Include diagrams of the middle ear, discharge and grommets to promote understanding of the written information. Videos should provide access to a script.
Actionability	
Behaviour	Explicitly state actions by directly addressing the user. Personal pronouns should be used to encourage efficacious behaviours.

4.7.1.3 How to Improve the Use of Plain Language of OM-related online information

Table 9 provides recommendations for incorporating plain language in OM-related online information.

Table 9. Recommendations for Improving Plain Language scores of OM-related Online Information.

Plain Language Factor	**Recommendation**
Reader Focus	
Relevance	Focus on clearly describing the types of OM, symptoms, causes, diagnosis and treatment.
Headings	First heading should include the topic of interest e.g. OM or ear infection.
Introduction	Include a short section at the beginning of the publication with the different topics or headings that will be discussed in the webpage.
Organisation	
Most important message at beginning of material	The most important message should be a summary of the information e.g. definition of OM, prevalence in children and common symptoms.
Sensible order	The order of information should not confuse the reader. A common order that was presented involved definition, symptoms, causes, diagnosis, treatment and prevention.
Headings/subheadings	Use short headings to outline new information. It should allow readers to clearly navigate the webpage.
Writing	
Active voice	Use active voice to engage the reader and encourage comprehensibility.
Unnecessary words	Avoid unnecessary words including technical jargon or adverbs.
Simple sentences	Use short sentences to promote understanding and retention of key messages. Avoid including more than one idea per sentence.

Correct punctuation	Use correct punctuation to give the intended meaning to the language. Information should not be up to interpretation for the reader.
Correct grammar	Use correct grammar to enhance comprehensibility.
Personal pronouns	Directly address the reader using the pronoun 'you' regarding desirable health behaviours e.g. you should seek a medical professional if you are experiencing persistent ear pain.
Lay terms	Present information in a conversational, informal tone to engage the reader.
Technical terms	Technical terms should be clearly defined in lay terms. A glossary of medical terms may be helpful.
Design and Formatting	
Clean font	Use clean font consistently throughout the publication. Unique fonts can undermine credibility and make the text illegible.
Large text size	Use text size that is easy to read. Each line should have about 10-15 words.
Typography	Typographic cues should be used to direct attention to key terms or important ideas. Excessive typographic cues can clutter the information and confuse the reader.
Appearance	Use white space to reduce clutter. Use high contrast colours to clearly differentiate text from background.
Images	Images should supplement the information e.g. labelled diagram of the middle ear presenting the different causes of ear infections.

4.7.2 Recommendations for Webpage Developers

The internet has the potential to be an effective patient information resource. However, it can only be beneficial to consumers if online health information is accessible, accurate and reliable. Webpage developers should create new information as well as adapt current material so that it is relevant and understandable to a diverse range of individuals (Nasser, Mullan, & Bajorek, 2012). This can be achieved by using best practice guidelines to address these ongoing issues. For this to be effective, information that is already accessible to

the public as well as new information needs to be assessed using strict criteria. Developers should use readability formulas and plain language tools to ensure that it is written at or below the recommended 6th RGL. The quality of OM-related information should be analysed using the DISCERN, as it largely focuses on treatment choices. Changes should be made according to the feedback that is provided. In the case of OM-related information, this should involve improving the transparency of the sources of information used to produce the publication. Furthermore, in-depth information regarding the risks of treatment and support for shared decision-making is likely to motivate readers to become actively involved in their health process. Content should also be verified using other tools such as the PEMAT to assess the understandability and actionability of the information. The findings of this study show that improvements should be made regarding the use of lay terms and technical terms.

4.7.3 Recommendations for Health Care Professionals

Although the use of the internet is becoming more common, medical professionals still the most trusted source of health information (Fox & Rainie, 2002). Approximately 40 to 80% of health information that is given by professionals is forgotten instantly (Kessels, 2003). Memory is hindered by factors such as old age and anxiety (Kessels, 2003). Therefore, clinicians have a responsibility to educate patients with information that facilitates their learning. This applies to both verbal and written information. Professionals should use a conversational, informal tone and common terms whenever possible (Stableford & Mettger, 2007). Furthermore, knowledge on health literacy is critical in understanding its effect on health inequalities and general health outcomes. They should be aware of the quality of information that is currently accessible to the public. Moreover, they should possess the skills required to evaluate the readability and quality of information. This will allow professionals to guide their patients to information that is beneficial to them. Table 10 provides the webpages that obtained the highest scores for readability, DISCERN, PEMAT and plain

language. This may be helpful for professionals to focus on webpages that can be confidently recommended to patients. In doing so, patients will better understand the information so that they have the opportunity to make informed treatment choices.

Table 10. Highest-rated OM-related Webpages for Readability, DISCERN, PEMAT and Plain Language.

Assessment Tool	**Webpage**
Readability	• https://www.stylecraze.com/articles/home-remedies-for-ear-infections/#gref • https://www.manicapost.co.zw/troubled-by-earache/
DISCERN	• https://www.hse.ie/eng/health/az/e/ear-infection,-inner/symptoms-of-otitis-media.html • https://ada.com/signs-of-ear-infection/
PEMAT	• https://parenting.firstcry.com/articles/ear-infection-in-kids/ • https://www2.hse.ie/conditions/earache.html#.XPtnENMza8V
Plain Language	• https://www.businessdailyafrica.com/magazines/The-dangers-of-ear-infection-/1248928-1739358-format-xhtml-56xvktz/index.html • http://www.medsquirrel.co.za/DrDemo10/?page=Detail&contentid=4548 • https://www.verywellhealth.com/what-causes-ear-infections-1191903 • https://www.consumer.org.nz/articles/choosing-wisely-ear-infection • https://www.merckmanuals.com/en-pr/home/quick-facts-ear,-nose,-and-throat-disorders/middle-ear-disorders/ear-infection-acute-otitis-media • https://www.verywellhealth.com/otalgia-and-ear-pain-1191949 • https://www.wellvenue.com/10-proven-home-remedies-for-a-baby-ear-infection/

4.8 Limitations and Future Research

4.8.1 Limitations of Assessment Tools

The most common concern about readability formulas is that their results are not a direct measure of comprehension (Kauchak & Leroy, 2016). They are solely based on the length and structure of a sentence (Zheng & Yu, 2017). In general, they assume that the longer words and sentences, the more difficult the text is (Zheng & Yu, 2017). It is true that long words require more effort for it to be retained in short-term memory (McLaughlin, 1969). However, there are problems that also occur when information is too simple as it can be difficult to convey accurate information (Weiss, 2003). In addition to this, readability formulas ignore other important factors that influence comprehension. This includes the characteristics of the webpage itself such as the design, fluency of the text, and the use of illustrations (Badarudeen & Sabharwal, 2010). Moreover, personal attributes such as interest, prior knowledge, and motivation are ignored (Meade & Smith, 1991).

Readability formulas are difficult to interpret as they do not identify aspects of a text that is difficult to read nor do they provide alternatives to try lower the RGL (Kauchak & Leroy, 2016). This was evident in this study as low readability did not necessarily equate to having high DISCERN and PEMAT scores and vice versa. It is important that users understand the purpose of using these algorithms and its limitations. It should be used in conjunction with other tools to identify aspects of information that require improvement.

The DISCERN is another tool that has its limitations. It is important to recognise that it does not assess the accuracy of information (Charnock, 1997). It allows users to understand what aspects should be included for it to be a quality publication. For example, it notes that a quality publication should include evidence-based sources of information that will provide fair and impartial information (Charnock, 1997). Relatedly, the PEMAT is another tool that does not assess important aspects of health information such as its accuracy, comprehensiveness, or cultural appropriateness (Shoemaker et al., 2014). As with all newly

developed tools like the PEMAT, further validation is required to be able to compare the PEMAT results to other results using different instruments as well as comparing results from other studies investigating similar topics. Although both tools have elements of subjectivity for most criteria, the present study demonstrated good inter-rater reliability.

It is important to recognise that the validity and reliability of the plain language checklist used in this study was not established. The plain language checklist generated from this study was adapted by combining three checklists developed by a group of authors who support the use of clear communication and improving health literacy. The conclusions that were made from the plain language checklist supported the results from the PEMAT and DISCERN. For example, a strength that was identified in both the plain language checklist and the PEMAT was that OM-related information was organised in a logical manner. In contrast, a weakness that was identified in both tools was the use of lay terms and lack of definition of technical terms. Although the inter-rater agreement for plain language scores was high, further research could focus on consumer testing to produce evidence of construct validity.

4.8.2 Study Limitations and Future Research

The present study had several limitations. The advanced search was performed only on the most common search engine, Google (www.google.com). Furthermore, only information that was in English was evaluated. Thus, the sample size may not have been a complete representation of OM-related online information that is accessible to the public. Future research could investigate information using other search engines such as Bing and Yahoo and other languages. It is also worth mentioning that the findings of this study were valid at the time of the Google search. Although it is likely that the results would have remained relatively stable over a given amount of time, it is important to recognise that internet information is constantly being updated.

Another limitation is that the DISCERN and PEMAT results were reported differently to some literature. This study used the overall quality rating of the publication to carry out hypothesis testing. Although many hearing-related information reported the results in a similar way (range from 1 to 5), previous literature investigating OM-related information used the total DISCERN score (range from 16 to 80). Furthermore, the PEMAT subscales were combined to carry out parametric analysis. This limited the interpretation of the findings and made it difficult to compare the findings to previous literature as some studies reported the subscales separately. This was particularly the case for the studies that investigated the influence of locality and type of organisation for health information. Future research on OM-related information could aim to report results in a similar way so that findings can be compared with previous literature.

To date, there has been no other study that has used top search terms that have been obtained from informants in the general public. Furthermore, no other study has investigated the understandability, actionability, and the use of plain language of OM-related online information. Future research could assess the accuracy and suitability of the information and incorporate consumer feedback. This could be done using a qualitative approach to determine how beneficial the information is in answering their health questions. Understanding people's perspectives may highlight any misconceptions that may be having an influence on their health decisions.

4.9 Conclusions

Globally, the internet has become an important source for health information that highly influences people's decision-making processes. This is particularly the case for parents and caregivers who access the internet for common paediatric conditions such as OM. The findings of this study show that the readability of OM-related online information is high. The quality is of a 'below-moderate' rating and the understandability, actionability, and use of plain language is adequate. Changes need to be made to existing resources in the specific areas that have been recognised in this study. Moreover, webpage developers and health care professionals need to focus on these weaknesses in order to develop new information that is beneficial to readers and their patients. This will be an effective way of educating readers about the condition itself and encouraging those to take appropriate steps of action.

References

Ad Hoc Committee on Health Literacy for the American Council on Scientific Affairs, A. M. A. (1999). Health Literacy: Report of the Council on Scientific Affairs. *Journal of the American Medical Association, 281*, 552-557. doi:10.1001/jama.281.6.552

Agarwal, R., Sands, D. Z., & Schneider, J. D. (2010). Quantifying the economic impact of communication inefficiencies in U.S. hospitals. *J Healthc Manag, 55*(4), 265-281; discussion 281-262

Agency for Healthcare Research and Quality. (2019). The Patient Education Materials Assessment Tool (PEMAT) and User's Guide. Retrieved from https://www.ahrq.gov/ncepcr/tools/self-mgmt/pemat-p.html

Ahmad, F., Hudak, P. L., Bercovitz, K., Hollenberg, E., & Levinson, W. (2006). Are physicians ready for patients with Internet-based health information? *J Med Internet Res, 8*(3), e22. doi: 10.2196/jmir.8.3.e22

Alamoudi, U., & Hong, P. (2015). Readability and quality assessment of websites related to microtia and aural atresia. *Int J Pediatr Otorhinolaryngol, 79*(2), 151-156. doi: 10.1016/j.ijporl.2014.11.027

American Academy of Family Physicians American Academy of Otolaryngology-Head Neck Surgery American Academy of Pediatrics Subcommittee on Otitis Media With Effusion. (2004). Otitis media with effusion. *Pediatrics, 113*(5), 1412-1429. doi: 10.1542/peds.113.5.1412

American Academy of Pediatrics. (2004). Diagnosis and management of acute otitis media. *Pediatrics, 113*(5), 1451-1465. doi: 10.1542/peds.113.5.1451

Anwar, K., Khan, S., Rehman, H. U., Javaid, M., & Shahabi, I. (2016). Otitis media with effusion: Accuracy of tympanometry in detecting fluid in the middle ears of children at myringotomies. *Pak J Med Sci, 32*(2), 466-470. doi: 10.12669/pjms.322.9009

Atcherson, S. R., DeLaune, A. E., Hadden, K., Zraick, R. I., Kelly-Campbell, R. J., & Minaya, C. P. (2014). A computer-based readability analysis of consumer materials on the American Speech-Language-Hearing Association website. *Contemporary Issues in Communication Science and Disorders, 41*(Apr), 12-23.

Atcherson, S. R., Zraick, R. I., & Hadden, K. (2013). A need for health literacy curriculum: knowledge of health literacy among U.S. audiologists and speech-language pathologists in Arkansas. *Educ Health (Abingdon), 26*(2), 85-88. doi: 10.4103/1357-6283.120699

Azios, J. H., Bellon-Harn, M., Dockens, A. L., & Manchaiah, V. (2019). Quality and readability of English-language internet information for aphasia. *Int J Speech Lang Pathol, 21*(1), 1-9. doi: 10.1080/17549507.2017.1362034

Badarudeen, S., & Sabharwal, S. (2010). Assessing readability of patient education materials: current role in orthopaedics. *Clin Orthop Relat Res, 468*(10), 2572-2580. doi: 10.1007/s11999-010-1380-y

Bae, J. M. (2017). Shared decision making: relevant concepts and facilitating strategies. *Epidemiol Health, 39*, e2017048. doi: 10.4178/epih.e2017048

Balakrishnan, V., Chandy, Z., Hseih, A., Bui, T. L., & Verma, S. P. (2016). Readability and Understandability of Online Vocal Cord Paralysis Materials. *Otolaryngol Head Neck Surg, 154*(3), 460-464. doi: 10.1177/0194599815626146

Balkany, T. J., Downs, M. P., Jafek, B. W., & Krajicek, M. J. (1978). Otologic manifestations of Down's syndrome. *Surg Forum, 29*, 582-585.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev, 84*(2), 191-215. doi: 10.1037/0033-295x.84.2.191

Bandura, A. (1986). The explanatory and predictve scope of self-efficacy theory. *Journal of Social and Clinical Psychology, 4*, 359-373. doi: 10.1521/jscp.1986.4.3.359

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Educ Behav, 31*(2), 143-164. doi: 10.1177/1090198104263660

Barak, A., & Sadovsky, Y. (2008). Internet use and personal empowerment of hearing-impaired adolescents. *Computers in Human Behavior, 24*, 1802-1815. doi: 10.1016/j.chb.2008.02.007

Bass, S. B., Ruzek, S. B., Gordon, T. F., Fleisher, L., McKeown-Conn, N., & Moore, D. (2006). Relationship of Internet health information use with patient behavior and self-efficacy: experiences of newly diagnosed cancer patients who contact the National Cancer Institute's Cancer Information Service. *J Health Commun, 11*(2), 219-236. doi: 10.1080/10810730500526794

Batchelor, J. M., & Ohya, Y. (2009). Use of the DISCERN instrument by patients and health professionals to assess information resources on treatments for asthma and atopic dermatitis. *Allergol Int, 58*(1), 141-145. doi: 10.2332/allergolint.08-SC-0022

Benjamin, R. M. (2010). Improving health by improving health literacy. *Public Health Rep, 125*(6), 784-785. doi: 10.1177/003335491012500602

Berger, G. (1989). Nature of spontaneous tympanic membrane perforation in acute otitis media in children. *J Laryngol Otol, 103*(12), 1150-1153. doi:1017/s0022215100111247

Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., & Crotty, K. (2011). Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med, 155*(2), 97-107. doi: 10.7326/0003-4819-155-2-201107190-00005

Berland, G. K., Elliott, M. N., Morales, L. S., Algazy, J. I., Kravitz, R. L., Broder, M. S., . . . McGlynn, E. A. (2001). Health information on the Internet: accessibility, quality, and readability in English and Spanish. *JAMA, 285*(20), 2612-2621. doi: 10.1001/jama.285.20.2612

Bernstam, E. V., Shelton, D. M., Walji, M., & Meric-Bernstam, F. (2005). Instruments to assess the quality of health information on the World Wide Web: what can our patients actually use? *Int J Med Inform, 74*(1), 13-19. doi: 10.1016/j.ijmedinf.2004.10.001

Blanchard, C. G., Labrecque, M. S., Ruckdeschel, J. C., & Blanchard, E. B. (1988). Information and decision-making preferences of hospitalized adult cancer patients. *Soc Sci Med, 27*(11), 1139-1145. doi: 10.1016/0277-9536(88)90343-7

Bluestone, C. D., & Cantekin, E. I. (1979). Design factors in the characterization and identification of otitis media and certain related conditions. *Ann Otol Rhinol Laryngol Suppl, 88*(5 Pt 2 Suppl 60), 13-28. doi:10.1177/00034894790880s503

Boonacker, C. W., Rovers, M. M., Browning, G. G., Hoes, A. W., Schilder, A. G., & Burton, M. J. (2014). Adenoidectomy with or without grommets for children with otitis media: an individual patient data meta-analysis. *Health Technol Assess, 18*(5), 1-118. doi: 10.3310/hta18050

Boothroyd, A. (2007). Adult aural rehabilitation: what is it and does it work? *Trends Amplif, 11*(2), 63-71. doi: 10.1177/1084713807301073

Bostock, S., & Steptoe, A. (2012). Association between low functional health literacy and mortality in older adults: longitudinal cohort study. *BMJ, 344*, e1602. doi: 10.1136/bmj.e1602

Bowatte, G., Tham, R., Allen, K. J., Tan, D. J., Lau, M., Dai, X., & Lodge, C. J. (2015). Breastfeeding and childhood acute otitis media: a systematic review and meta-analysis. *Acta Paediatr, 104*(467), 85-95. doi: 10.1111/apa.13151

Boztas, N., Omur, D., Ozbilgin, S., Altuntas, G., Piskin, E., Ozkardesler, S., & Hanci, V. (2017). Readability of internet-sourced patient education material related to "labour analgesia". *Medicine (Baltimore), 96*(45), e8526. doi: 10.1097/MD.0000000000008526

Bundorf, M. K., Wagner, T. H., Singer, S. J., & Baker, L. C. (2006). Who searches the internet for health information? *Health Serv Res, 41*(3 Pt 1), 819-836. doi: 10.1111/j.1475-6773.2006.00510.x

Cacciatore, F., Napoli, C., Abete, P., Marciano, E., Triassi, M., & Rengo, F. (1999). Quality of life determinants and hearing function in an elderly population: Osservatorio Geriatrico Campano Study Group. *Gerontology, 45*(6), 323-328. doi: 10.1159/000022113

Carlsson, P. I., Hjaldahl, J., Magnuson, A., Ternevall, E., Eden, M., Skagerstrand, A., & Jonsson, R. (2015). Severe to profound hearing impairment: quality of life, psychosocial consequences and audiological rehabilitation. *Disabil Rehabil, 37*(20), 1849-1856. doi: 10.3109/09638288.2014.982833

Casselbrant, M. L., Mandel, E. M., Fall, P. A., Rockette, H. E., Kurs-Lasky, M., Bluestone, C. D., & Ferrell, R. E. (1999). The heritability of otitis media: a twin and triplet study. *JAMA, 282*(22), 2125-2130. doi: 10.1001/jama.282.22.2125

Center for Health Literacy. (2019). *Quick Checklist for Plain Language.* Retrieved from https://www.slideshare.net/PlainTalkConf/jeanne-mcgee-and-the-center-for-health-literacy-quick-checklist-for-plain-language

Central Intelligence Agency. (2007). *The World Factbook 2007:* Government Printing Office

Charnock, D. (1997). *The DISCERN Handbook: Quality criteria for consumer health information on treatment choices.* Retrieved from http://www.discern.org.uk/discern.pdf

Charnock, D., & Shepperd, S. (2004). Learning to DISCERN online: applying an appraisal tool to health websites in a workshop setting. *Health Educ Res, 19*(4), 440-446. doi: 10.1093/her/cyg046

Charnock, D., Shepperd, S., Needham, G., & Gann, R. (1999). DISCERN: an instrument for judging the quality of written consumer health information on treatment choices. *J Epidemiol Community Health, 53*(2), 105-111. doi: 10.1136/jech.53.2.105

Chen, Y. Y., Li, C. M., Liang, J. C., & Tsai, C. C. (2018). Health Information Obtained From the Internet and Changes in Medical Decision Making: Questionnaire Development and Cross-Sectional Survey. *J Med Internet Res, 20*(2), e47. doi: 10.2196/jmir.9370

Chi-Lum, B. (1999). Friend or foe? Consumers using the Internet for medical information. *J Med Pract Manage, 14*(4), 196-198.

Chia, E. M., Wang, J. J., Rochtchina, E., Cumming, R. R., Newall, P., & Mitchell, P. (2007). Hearing impairment and health-related quality of life: the Blue Mountains Hearing Study. *Ear Hear, 28*(2), 187-195. doi: 10.1097/AUD.0b013e31803126b6

Cline, R. J., & Haynes, K. M. (2001). Consumer health information seeking on the Internet: the state of the art. *Health Educ Res, 16*(6), 671-692. doi: 10.1093/her/16.6.671

Connolly, K. K., & Crosby, M. E. (2014). Examining e-Health literacy and the digital divide in an underserved population in Hawai'i. *Hawaii J Med Public Health, 73*(2), 44-48.
Couper, M. P., Singer, E., Levin, C. A., Fowler, F. J., Jr., Fagerlin, A., & Zikmund-Fisher, B. J. (2010). Use of the Internet and ratings of information sources for medical decisions: results from the DECISIONS survey. *Med Decis Making, 30*(5 Suppl), 106S-114S. doi: 10.1177/0272989X10377661
Cutilli, C. C. (2010). Seeking health information: what sources do your patients use? *Orthop Nurs, 29*(3), 214-219. doi: 10.1097/NOR.0b013e3181db5471
Damoiseaux, R. A., & Rovers, M. M. (2011). AOM in children. *BMJ Clin Evid, 2011*.
Danishyar, A., & Ashurst, J. V. (2019). Acute Otitis Media *StatPearls*. Treasure Island (FL).
Daraz, L., Morrow, A. S., Ponce, O. J., Beuschel, B., Farah, M. H., Katabi, A., . . . Murad, M. H. (2019). Can Patients Trust Online Health Information? A Meta-narrative Systematic Review Addressing the Quality of Health Information on the Internet. *J Gen Intern Med, 34*(9), 1884-1891. doi: 10.1007/s11606-019-05109-0
Daraz, L., Morrow, A. S., Ponce, O. J., Farah, W., Katabi, A., Majzoub, A., . . . Murad, M. H. (2018). Readability of Online Health Information: A Meta-Narrative Systematic Review. *Am J Med Qual, 33*(5), 487-492. doi: 10.1177/1062860617751639
Davis, T. C., Williams, M. V., Marin, E., Parker, R. M., & Glass, J. (2002). Health literacy and cancer communication. *CA Cancer J Clin, 52*(3), 134-149. doi: 10.3322/canjclin.52.3.134
Dewalt, D. A., Berkman, N. D., Sheridan, S., Lohr, K. N., & Pignone, M. P. (2004). Literacy and health outcomes: a systematic review of the literature. *J Gen Intern Med, 19*(12), 1228-1239. doi: 10.1111/j.1525-1497.2004.40153.x
Diviani, N., van den Putte, B., Giani, S., & van Weert, J. C. (2015). Low health literacy and evaluation of online health information: a systematic review of the literature. *J Med Internet Res, 17*(5), e112. doi: 10.2196/jmir.4018
Doak, C. C., Doak, L. G., & Root, J. H. (1996). *Teaching patients with low literacy skills* (2nd ed.). Philadelphia: J. B. Lippincott & Co.
Donald, A. J., & Kelly-Campbell, R. J. (2016). Pediatric Audiology Report: Assessment and Revision of an Audiology Report Written to Parents of Children With Hearing Impairment. *J Speech Lang Hear Res, 59*(2), 359-372. doi: 10.1044/2015_JSLHR-H-15-0120
DuBay, W. H. (2004). *The Principles of Readability*. Costa Mesa CA: Impact Information.
Dueppen, A. J., Bellon-Harn, M. L., Radhakrishnan, N., & Manchaiah, V. (2019). Quality and Readability of English-Language Internet Information for Voice Disorders. *J Voice, 33*(3), 290-296. doi: 10.1016/j.jvoice.2017.11.002
Easton, P., Entwistle, V. A., & Williams, B. (2013). How the stigma of low literacy can impair patient-professional spoken interactions and affect health: insights from a qualitative investigation. *BMC Health Serv Res, 13*, 319. doi: 10.1186/1472-6963-13-319
Edejer, T. T. (2000). Disseminating health information in developing countries: the role of the internet. *BMJ, 321*(7264), 797-800. doi: 10.1136/bmj.321.7264.797
Eloy, J. A., Li, S., Kasabwala, K., Agarwal, N., Hansberry, D. R., Baredes, S., & Setzen, M. (2012). Readability assessment of patient education materials on major otolaryngology association websites. *Otolaryngol Head Neck Surg, 147*(5), 848-854. doi: 10.1177/0194599812456152

Eltorai, A. E., Ghanian, S., Adams, C. A., Jr., Born, C. T., & Daniels, A. H. (2014). Readability of patient education materials on the american association for surgery of trauma website. *Arch Trauma Res, 3*(2), e18161. doi: 10.5812/atr.18161

Elwyn, G., Laitner, S., Coulter, A., Walker, E., Watson, P., & Thomson, R. (2010). Implementing shared decision making in the NHS. *BMJ, 341*, c5146. doi: 10.1136/bmj.c5146

Ericcson, K. A., Chase, W. G., & Faloon, S. (1980). Acquisition of a memory skill. *Science, 208*(4448), 1181-1182. doi: 10.1126/science.7375930

Eskin, B. (2004). Evidence-based emergency medicine/systematic review abstract. Should children with otitis media be treated with antibiotics? *Ann Emerg Med, 44*(5), 537-539. doi: 10.1016/j.annemergmed.2004.07.447

Eysenbach, G., & Kohler, C. (2002). How do consumers search for and appraise health information on the world wide web? Qualitative study using focus groups, usability tests, and in-depth interviews. *BMJ, 324*(7337), 573-577. doi: 10.1136/bmj.324.7337.573

Eysenbach, G., Powell, J., Kuss, O., & Sa, E. R. (2002). Empirical studies assessing the quality of health information for consumers on the world wide web: a systematic review. *JAMA, 287*(20), 2691-2700. doi: 10.1001/jama.287.20.2691

Fage-Butler, A. M., & Nisbeth Jensen, M. (2016). Medical terminology in online patient-patient communication: evidence of high health literacy? *Health Expect, 19*(3), 643-653. doi: 10.1111/hex.12395

Fahy, E., Hardikar, R., Fox, A., & Mackay, S. (2014). Quality of patient health information on the Internet: reviewing a complex and evolving landscape. *Australas Med J, 7*(1), 24-28. doi: 10.4066/AMJ.2014.1900

Fergie, G., Hunt, K., & Hilton, S. (2013). What young people want from health-related online resources: a focus group study. *J Youth Stud, 16*(5), 579-596. doi: 10.1080/13676261.2012.744811

Finkelstein, Y., Ophir, D., Talmi, Y. P., Shabtai, A., Strauss, M., & Zohar, Y. (1994). Adult-onset otitis media with effusion. *Arch Otolaryngol Head Neck Surg, 120*(5), 517-527. doi:10.1001/archotol.1994.01880290029006

Fitzsimmons, P. R., Michael, B. D., Hulley, J. L., & Scott, G. O. (2010). A readability assessment of online Parkinson's disease information. *J R Coll Physicians Edinb, 40*(4), 292-296. doi: 10.4997/JRCPE.2010.401

Fleiss, J. L. (1981). *Statistical Methods for Rates and Proportions* (2 ed.). New York: John Wiley

Fox, S., & Rainie, L. (2002). *Vital decisions: A Pew Internet Health Report.* Retrieved from http://pewinternet.org/2002/05/22-vital-decisions-a-pew-internet-health-report/

Freda, M. C. (2005). The readability of American Academy of Pediatrics patient education brochures. *J Pediatr Health Care, 19*(3), 151-156. doi: 10.1016/j.pedhc.2005.01.013

French, K. S., & Larrabee, J. H. (1999). Relationships among educational material readability, client literacy, perceived beneficence, and perceived quality. *J Nurs Care Qual, 13*(6), 68-82. doi: 10.1097/00001786-199908000-00008

Gazarian, P. K., Cronin, J., Dalto, J. L., Baker, K. M., Friel, B. J., Bruce-Baiden, W., & Rodriguez, L. Y. (2019). A systematic evaluation of advance care planning patient educational resources. *Geriatr Nurs, 40*(2), 174-180. doi: 10.1016/j.gerinurse.2018.09.011

Goslin, R. A., & Elhassan, H. A. (2013). Evaluating internet health resources in ear, nose, and throat surgery. *Laryngoscope, 123*(7), 1626-1631. doi: 10.1002/lary.23773

Graham, S., & Brookey, J. (2008). Do patients understand? *The Permanente journal, 12*(3), 67-69. doi: 10.7812/tpp/07-144

Grene, M., Cleary, Y., & Marcus-Quinn, A. (2017). Use of plain-language guidelines to promote health literacy. *IEEE Transactions on Professional Communication, 60*(3), 384. doi: 10.1109/tpc.2017.2761578

Gribben, B., Salkeld, L. J., Hoare, S., & Jones, H. F. (2012). The incidence of acute otitis media in New Zealand children under five years of age in the primary care setting. *J Prim Health Care, 4*(3), 205-212. doi:10.1071/hc12205.

Grime, J., Blenkinsopp, A., Raynor, D. K., Pollock, K., & Knapp, P. (2007). The role and value of written information for patients about individual medicines: a systematic review. *Health Expect, 10*(3), 286-298. doi: 10.1111/j.1369-7625.2007.00454.x

Gunning, R. (1952). *The technique of clear writing*: McGraw-Hill.

Health on the Net. (2019). *HONcode certification.* Retrieved from https://www.hon.ch/HONcode/

Heine, C., & Browning, C. J. (2002). Communication and psychosocial consequences of sensory loss in older adults: overview and rehabilitation directions. *Disabil Rehabil, 24*(15), 763-773. doi: 10.1080/09638280210129162

Hesse, B. W., Moser, R. P., & Rutten, L. J. (2010). Surveys of physicians and electronic health information. *N Engl J Med, 362*(9), 859-860. doi: 10.1056/NEJMc0909595

Hoffman, H. J., Daly, K. A., Bainbridge, K. E., Casselbrant, M. L., Homoe, P., Kvestad, E., . . . Vernacchio, L. (2013). Panel 1: Epidemiology, natural history, and risk factors. *Otolaryngol Head Neck Surg, 148*(4 Suppl), E1-E25. doi: 10.1177/0194599812460984

Hsu, J., Huang, J., Kinsman, J., Fireman, B., Miller, R., Selby, J., & Ortiz, E. (2005). Use of e-Health services between 1999 and 2002: a growing digital divide. *J Am Med Inform Assoc, 12*(2), 164-171. doi: 10.1197/jamia.M1672

Hughes, T. M., Merath, K., Chen, Q., Sun, S., Palmer, E., Idrees, J. J., . . . Pawlik, T. M. (2018). Association of shared decision-making on patient-reported health outcomes and healthcare utilization. *Am J Surg, 216*(1), 7-12. doi: 10.1016/j.amjsurg.2018.01.011

Internet World Stats. (2019). *Internet usage statistics: the Internet big picture world Internet users and 2019 population stats.* Retrieved from https://www.internetworldstats.com/stats.htm

Ishikawa, H., & Yano, E. (2008). Patient health literacy and participation in the health-care process. *Health Expect, 11*(2), 113-122. doi: 10.1111/j.1369-7625.2008.00497.x

Jackson, L. A., Barbatsis, G., Von Eye, A., Biocca, F., Zhao, Y., & Fitzgerald, H. (2003). Internet use in low-income families: Implications for the digital divide. *It & Society, 1*(5), 141-165.

Jacobs, W., Amuta, A. O., & Jeon, K. C. (2017). Health information seeking in the digital age: An analysis of health information seeking behavior among US adults. *Cogent Social Sciences, 3*(1). doi: 10.1080/23311886.2017.1302785

Jadad, A. R., & Gagliardi, A. (1998). Rating health information on the Internet: navigating to knowledge or to Babel? *JAMA, 279*(8), 611-614. doi: 10.1001/jama.279.8.611

Janssen, S., Fahlbusch, F. B., Kasmann, L., Rades, D., & Vordermark, D. (2019). Radiotherapy for prostate cancer: DISCERN quality assessment of patient-oriented websites in 2018. *BMC Urol, 19*(1), 42. doi: 10.1186/s12894-019-0474-4

Johnson, A. (2017). *Readability and quality of web-based information related to noise-induced hearing impairment.* University of Canterbury., Christchurch, New Zealand.

Joubert, K., & Githinji, E. (2014). Quality and readability of information pamphlets on hearing and paediatric hearing loss in the Gauteng Province, South Africa. *Int J Pediatr Otorhinolaryngol, 78*(2), 354-358. doi: 10.1016/j.ijporl.2013.12.018

Joury, A., Joraid, A., Alqahtani, F., Alghamdi, A., Batwa, A., & Pines, J. M. (2018). The variation in quality and content of patient-focused health information on the Internet for otitis media. *Child Care Health Dev, 44*(2), 221-226. doi: 10.1111/cch.12524

Kaicker, J., Debono, V. B., Dang, W., Buckley, N., & Thabane, L. (2010). Assessment of the quality and variability of health information on chronic pain websites using the DISCERN instrument. *BMC Med, 8*, 59. doi: 10.1186/1741-7015-8-59

Kamal, N., Joarder, A. H., Chowdhury, A. A., & Khan, A. W. (2004). Prevalence of chronic suppurative otitis media among the children living in two selected slums of Dhaka City. *Bangladesh Med Res Counc Bull, 30*(3), 95-104.

Kang, S. J., & Lee, M. S. (2019). Assessing of the audiovisual patient educational materials on diabetes care with PEMAT. *Public Health Nurs, 36*(3), 379-387. doi: 10.1111/phn.12577

Kasabwala, K., Agarwal, N., Hansberry, D. R., Baredes, S., & Eloy, J. A. (2012). Readability assessment of patient education materials from the American Academy of Otolaryngology--Head and Neck Surgery Foundation. *Otolaryngol Head Neck Surg, 147*(3), 466-471. doi: 10.1177/0194599812442783

Kauchak, D., & Leroy, G. (2016). Moving Beyond Readability Metrics for Health-Related Text Simplification. *IT Prof, 18*(3), 45-51. doi: 10.1109/MITP.2016.50

Kero, P., & Piekkala, P. (1987). Factors affecting the occurrence of acute otitis media during the first year of life. *Acta Paediatr Scand, 76*(4), 618-623. doi:10.1111/j.1651-2227.1987.tb10531.x

Kessels, R. P. (2003). Patients' memory for medical information. *J R Soc Med, 96*(5), 219-222. doi: 10.1258/jrsm.96.5.219

Kickbusch, I., Maag, D., & Wait, S. (2006). *Navigating health: The role of health literacy.* Retrieved from https://ilcuk.org.uk/navigating-health-the-role-of-health-literacy/

Kim, P., Eng, T. R., Deering, M. J., & Maxfield, A. (1999). Published criteria for evaluating health related web sites: review. *BMJ, 318*(7184), 647-649. doi: 10.1136/bmj.318.7184.647

Kincaid, J. P., Fishburne Jr, R. P., Rogers, R. L., & Chissom, B. S. (1975). *Derivation of new readability formulas (automated readability index, fog count and flesch reading ease formula) for navy enlishted personnel. .* Retrieved from http://stars.library.ucf.edu/cgi/viewcontent.cgi?article=1055&context=istlibrary

Klein, J. O. (1989). Epidemiology of otitis media. *Pediatr Infect Dis J, 8*(1 Suppl), S9. doi:10.1097/00006454-198901001-00004

Kontiokari, T., Koivunen, P., Niemela, M., Pokka, T., & Uhari, M. (1998). Symptoms of acute otitis media. *Pediatr Infect Dis J, 17*(8), 676-679. doi: 10.1097/00006454-199808000-00003

Kutner, M., Greenberg, E., Jin, Y., & Paulsen, C. (2006). *The health literacy of America's adults: Results from the 2003 National Assessment of Adult Literacy (NCES 2006-483)*. Washington, DC: U.S. Department of Education National Center for Education Statistics. doi: 10.1037/e530912012-001

LaPerriere, B., Edwards, P., Romeder, J. M., & Maxwell-Young, L. (1998). Using the Internet to support self-care. *Can Nurse, 94*(5), 47-48.

Laplante-Lévesque, A., Brännström, K. J., Andersson, G., & Lunner, T. (2012). Quality and readability of English-language internet information for adults with hearing impairment and their significant others. *Int J Audiol, 51*(8), 618-626. doi: 10.3109/14992027.2012.684406

Laplante-Lévesque, A., Hickson, L., & Worrall, L. (2010). Factors influencing rehabilitation decisions of adults with acquired hearing impairment. *Int J Audiol, 49*(7), 497-507. doi: 10.3109/14992021003645902

Leach, A. J., & Morris, P. S. (2006). Antibiotics for the prevention of acute and chronic suppurative otitis media in children. *Cochrane Database Syst Rev*(4), CD004401. doi: 10.1002/14651858.CD004401.pub2

Lee, J. S., Kim, M. G., Hong, S. M., Na, S. Y., Byun, J. Y., Park, M. S., & Yeo, S. G. (2014). Changing patterns of bacterial strains in adults and children with otitis media in korean tertiary care centers. *Clin Exp Otorhinolaryngol, 7*(2), 79-86. doi: 10.3342/ceo.2014.7.2.79

Lenhart, A., Rainie, L., Fox, S., Horrigan, J., & Spooner, T. (2000). *Who's not online: 57% of those without Internet access say they don't plan to log on*. Washington, DC: Pew Internet & American Life Project.

Ley, P., & Florio, T. (1996). The use of readability formulas in health care. *Psychology, Health & Medicine, 1*(1), 7-28. doi: 10.1080/13548509608400003

Lieberthal, A. S., Carroll, A. E., Chonmaitree, T., Ganiats, T. G., Hoberman, A., Jackson, M. A., . . . Tunkel, D. E. (2013). The diagnosis and management of acute otitis media. *Pediatrics, 131*(3), e964-999. doi: 10.1542/peds.2012-3488

Lipari, M., Berlie, H., Saleh, Y., Hang, P., & Moser, L. (2019). Understandability, actionability, and readability of online patient education materials about diabetes mellitus. *Am J Health Syst Pharm, 76*(3), 182-186. doi: 10.1093/ajhp/zxy021

Lopez Ramos, C., Williams, J. E., Bababekov, Y. J., Chang, D. C., Carter, B. S., & Jones, P. S. (2019). Assessing the Understandability and Actionability of Online Neurosurgical Patient Education Materials. *World Neurosurg, 130*, e588-e597. doi: 10.1016/j.wneu.2019.06.166

Lum, H. D., & Sudore, R. L. (2016). Advance Care Planning and Goals of Care Communication in Older Adults with Cardiovascular Disease and Multi-Morbidity. *Clin Geriatr Med, 32*(2), 247-260. doi: 10.1016/j.cger.2016.01.011

Manchaiah, V., Dockens, A. L., Flagge, A., Bellon-Harn, M., Azios, J. H., Kelly-Campbell, R. J., & Andersson, G. (2019). Quality and Readability of English-Language Internet Information for Tinnitus. *J Am Acad Audiol, 30*(1), 31-40. doi: 10.3766/jaaa.17070

Mastroianni, F., Chen, Y. C., Vellar, L., Cvejic, E., Smith, J. K., McCaffery, K. J., & Muscat, D. M. (2019). Implementation of an organisation-wide health literacy approach to improve the understandability and actionability of patient information and education materials: A pre-post effectiveness study. *Patient Educ Couns, 102*(9), 1656-1661. doi: 10.1016/j.pec.2019.03.022

McDonald, S., Langton Hewer, C. D., & Nunez, D. A. (2008). Grommets (ventilation tubes) for recurrent acute otitis media in children. *Cochrane Database Syst Rev*(4), CD004741. doi: 10.1002/14651858.CD004741.pub2

McInnes, N., & Haglund, B. J. (2011). Readability of online health information: implications for health literacy. *Inform Health Soc Care, 36*(4), 173-189. doi: 10.3109/17538157.2010.542529

McKearney, T. C., & McKearney, R. M. (2013). The quality and accuracy of internet information on the subject of ear tubes. *Int J Pediatr Otorhinolaryngol, 77*(6), 894-897. doi: 10.1016/j.ijporl.2013.03.021
McKinley, J., Cattermole, H., & Oliver, C. W. (1999). The quality of surgical information on the Internet. *J R Coll Surg Edinb, 44*(6), 403.
McLaughlin, G. H. (1969). SMOG grading - A new readability formula. *Journal of reading, 12*(8), 639-646.
McLaughlin, G. H. (1974). Temptations of the Flesch. *Instr Sci, 2*, 367-384.
McLellan, F. (1998). "Like hunger, like thirst": patients, journals, and the internet. *Lancet, 352 Suppl 2*, SII39-43. doi: 10.1016/s0140-6736(98)90301-4
Meade, C. D., & Smith, C. F. (1991). Readability formulas: Cautions and criteria. *Patient Educ Couns, 17*(2), 153-158. doi: 10.1016/0738-3991(91)90017-Y
Meherali, S., Campbell, A., Hartling, L., & Scott, S. (2019). Understanding Parents' Experiences and Information Needs on Pediatric Acute Otitis Media: A Qualitative Study. *J Patient Exp, 6*(1), 53-61. doi: 10.1177/2374373518771362
Meyer, C., Hickson, L., & Fletcher, A. (2014). Identifying the barriers and facilitators to optimary hearing aid self-efficacy. *Int J Audiol*, 53(supl), S28-S37. doi: 10.3109/14992027.2013.832420
Miller, G. A. (1956). The magical number seven plus or minus two: some limits on our capacity for processing information. *Psychol Rev, 63*(2), 81-97. doi: 10.1037/h0043158
Mills, N., Best, E. J., Murdoch, D., Souter, M., Neeff, M., Anderson, T., . . . Walls, T. (2015). What is behind the ear drum? The microbiology of otitis media and the nasopharyngeal flora in children in the era of pneumococcal vaccination. *J Paediatr Child Health, 51*(3), 300-306. doi: 10.1111/jpc.12710
Ministry of Health | Manatū Hauora. (2010). *Kōrero Mārama: Health Literacy and Māori: Results from the 2006 Adult Literacy and Life Skills Survey.* Retrieved from https://www.health.govt.nz/system/files/documents/publications/korero-marama.pdf
Ministry of Health | Manatū Hauora. (2015). *A Framework for Health Literacy*. Wellington,. Ministry of Health.
Mittal, R., Lisi, C. V., Gerring, R., Mittal, J., Mathee, K., Narasimhan, G., . . . Liu, X. Z. (2015). Current concepts in the pathogenesis and treatment of chronic suppurative otitis media. *J Med Microbiol, 64*(10), 1103-1116. doi: 10.1099/jmm.0.000155
Monasta, L., Ronfani, L., Marchetti, F., Montico, M., Vecchi Brumatti, L., Bavcar, A., . . . Tamburlini, G. (2012). Burden of disease caused by otitis media: systematic review and global estimates. *PLoS One, 7*(4), e36226. doi: 10.1371/journal.pone.0036226
Morris, P. S., & Leach, A. J. (2009a). Acute and chronic otitis media. *Pediatr Clin North Am, 56*(6), 1383-1399. doi: 10.1016/j.pcl.2009.09.007
Morris, P. S., & Leach, A. J. (2009b). Managing otitis media: an evidence based approach. *Aust Prescr, 32*, 155-159.
Murphy, T. F., Chonmaitree, T., Barenkamp, S., Kyd, J., Nokso-Koivisto, J., Patel, J. A., . . . Pettigrew, M. M. (2013). Panel 5: Microbiology and immunology panel. *Otolaryngol Head Neck Surg, 148*(4 Suppl), E64-89. doi: 10.1177/0194599812459636
Naseribooriabadi, T., Sadoughi, F., & Sheikhtaheri, A. (2017). Barriers and Facilitators of Health Literacy among D/deaf Individuals: A Review Article. *Iran J Public Health, 46*(11), 1465-1474.

Nasser, S., Mullan, J., & Bajorek, B. (2012). Assessing the quality, suitability and readability of internet-based health information about warfarin for patients. *Australas Med J, 5*(3), 194-203. doi: 10.4066/AMJ.2012862

National Adult Literacy Agency. (2019). *Plain English Checklist for Documents.* Retrieved from https://www.nala.ie/publications/a-plain-english-checklist-for-documents/

Newman, C. W., Jacobson, G. P., Hug, G. A., & Sandridge, S. A. (1997). Perceived hearing handicap of patients with unilateral or mild hearing loss. *Ann Otol Rhinol Laryngol, 106*(3), 210-214. doi: 10.1177/000348949710600305

Nickel, B., Barratt, A., Copp, T., Moynihan, R., & McCaffery, K. (2017). Words do matter: a systematic review on how different terminology for the same condition influences management preferences. *BMJ Open, 7*(7), e014129. doi: 10.1136/bmjopen-2016-014129

Norman, C. D., & Skinner, H. A. (2006). eHEALS: The eHealth Literacy Scale. *J Med Internet Res, 8*(4), e27. doi: 10.2196/jmir.8.4.e27

Nutbeam, D. (1986). Health promotion glossary. *Health Promot, 1*(1), 113-127. doi:10.1093.heapro/1.1.113

Nutbeam, D. (2000). Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International, 15*(3), 259-267. doi:10.1093/heapro/15.3.259

Nutbeam, D. (2008). The evolving concept of health literacy. *Soc Sci Med, 67*(12), 2072-2078. doi: 10.1016/j.socscimed.2008.09.050

O'Connor, T. E., Perry, C. F., & Lannigan, F. J. (2009). Complications of otitis media in Indigenous and non-Indigenous children. *Med J Aust, 191*(9 Suppl), S60-64. doi:10.5694/j.1326-5377.2009.tb02929.x

Otal, D., Wizowski, L., Pemberton, J., Nagel, K., Fitzgerald, P., & Walton, J. M. (2012). Parent health literacy and satisfaction with plain language education materials in a pediatric surgery outpatient clinic: a pilot study. *J Pediatr Surg, 47*(5), 964-969. doi: 10.1016/j.jpedsurg.2012.01.057

Paasche-Orlow, M. K., Parker, R. M., Gazmararian, J. A., Nielsen-Bohlman, L. T., & Rudd, R. R. (2005). The prevalence of limited health literacy. *J Gen Intern Med, 20*(2), 175-184. doi: 10.1111/j.1525-1497.2005.40245.x

Parikh, N. S., Parker, R. M., Nurss, J. R., Baker, D. W., & Williams, M. V. (1996). Shame and health literacy: the unspoken connection. *Patient Educ Couns, 27*(1), 33-39. doi: 10.1016/0738-3991(95)00787-3

Parker, R. M. (2000). Health literacy: a challenge for American patients and their health care providers. *Health Promotion International, 15*, 277-291. doi:10.1093/heapro/15.4.277

Pehora, C., Gajaria, N., Stoute, M., Fracassa, S., Serebale-O'Sullivan, R., & Matava, C. T. (2015). Are Parents Getting it Right? A Survey of Parents' Internet Use for Children's Health Care Information. *Interact J Med Res, 4*(2), e12. doi: 10.2196/ijmr.3790

Pew Research Center. (2011). *Health Topics.* Retrieved from http://www.pewinternet.org/2011/02/01/health-topics-4

Phillips, J. S., Yung, M. W., Burton, M. J., & Swan, I. R. (2007). Evidence review and ENT-UK consensus report for the use of aminoglycoside-containing ear drops in the presence of an open middle ear. *Clin Otolaryngol, 32*(5), 330-336. doi: 10.1111/j.1749-4486.2007.01532.x

Pianosi, K., Gorodzinsky, A. Y., Chorney, J. M., Corsten, G., Johnson, L. B., & Hong, P. (2016). Informed Consent in Pediatric Otolaryngology: What Risks and Benefits Do Parents

Recall? *Otolaryngol Head Neck Surg, 155*(2), 332-339. doi: 10.1177/0194599816641910

Plain Language Action and Information Network. (2019). *Checklist for Plain Language on the Web.* Retrieved from https://www.plainlanguage.gov/resources/checklists/web-checklist/

Pothier, D. D. (2005). Patients and the internet: are websites on glue ear readable? *Clin Otolaryngol, 30*(6), 566. doi: 10.1111/j.1749-4486.2005.01115.x

Potter, H. (2015). *Readability, quality and suitability of web-based consumer audiological health information for adults with a hearing impairment living in New Zealand.* University of Canterbury., Christchurch, New Zealand.

Powell, J. A., Darvell, M., & Gray, J. A. (2003). The doctor, the patient and the world-wide web: how the internet is changing healthcare. *J R Soc Med, 96*(2), 74-76. doi: 10.1258/jrsm.96.2.74

Powell, J. A., Inglis, N., Ronnie, J., & Large, S. (2011). The characteristics and motivations of online health information seekers: cross-sectional survey and qualitative interview study. *J Med Internet Res, 13*(1), e20. doi: 10.2196/jmir.1600

Pratt, M., & Searles, G. E. (2017). Using Visual Aids to Enhance Physician-Patient Discussions and Increase Health Literacy. *J Cutan Med Surg, 21*(6), 497-501. doi: 10.1177/1203475417715208

Psarommatis, I. M., Goritsa, E., Douniadakis, D., Tsakanikos, M., Kontrogianni, A. D., & Apostolopoulos, N. (2001). Hearing loss in speech-language delayed children. *Int J Pediatr Otorhinolaryngol, 58*(3), 205-210. doi:10.1016/s0165-5876(01)00430-x

Qureishi, A., Garas, G., Mallick, A., & Parker, D. (2014a). The psychosocial impact of hearing aids in children with otitis media with effusion. *J Laryngol Otol, 128*(11), 972-975. doi: 10.1017/S0022215114002163

Qureishi, A., Lee, Y., Belfield, K., Birchall, J. P., & Daniel, M. (2014b). Update on otitis media - prevention and treatment. *Infect Drug Resist, 7*, 15-24. doi: 10.2147/IDR.S39637

Rains, S. A. (2007). Perceptions of traditional information sources and use of the world wide web to seek health information: findings from the health information national trends survey. *J Health Commun, 12*(7), 667-680. doi: 10.1080/10810730701619992

Rasmussen, F. (1993). Protracted secretory otitis media. The impact of familial factors and day-care center attendance. *Int J Pediatr Otorhinolaryngol, 26*(1), 29-37. doi:10.1016/0165-5876(93)90193-7

Redmond, N., Baer, H. J., Clark, C. R., Lipsitz, S., & Hicks, L. S. (2010). Sources of health information related to preventive health behaviors in a national study. *Am J Prev Med, 38*(6), 620-627 e622. doi: 10.1016/j.amepre.2010.03.001

Reiss, M., & Reiss, G. (2010). [Suppurative chronic otitis media: etiology, diagnosis and therapy]. *Med Monatsschr Pharm, 33*(1), 11-16; quiz 17-18.

Ritchie, L., Tornari, C., Patel, P. M., & Lakhani, R. (2016). Glue ear: how good is the information on the World Wide Web? *J Laryngol Otol, 130*(2), 157-161. doi: 10.1017/S0022215115003230

Robillard, J. M., Jun, J. H., Lai, J. A., & Feng, T. L. (2018). The QUEST for quality online health information: validation of a short quantitative tool. *BMC Med Inform Decis Mak, 18*(1), 87. doi: 10.1186/s12911-018-0668-9

Robinson, T. N., Patrick, K., Eng, T. R., & Gustafson, D. (1998). An evidence-based approach to interactive health communication: a challenge to medicine in the information age. Science Panel on Interactive Communication and Health. *JAMA, 280*(14), 1264-1269. doi: 10.1001/jama.280.14.1264

Rosenfeld, R. M. (2000). Surgical prevention of otitis media. *Vaccine, 19 Suppl 1*, S134-139. doi:10.1016/s0264-410x(00)00292-9

Rosenfeld, R. M., Schwartz, S. R., Pynnonen, M. A., Tunkel, D. E., Hussey, H. M., Fichera, J. S., . . . Schellhase, K. G. (2013). Clinical practice guideline: Tympanostomy tubes in children. *Otolaryngol Head Neck Surg, 149*(1 Suppl), S1-35. doi: 10.1177/0194599813487302

Rovers, M. M., Schilder, A. G., Zielhuis, G. A., & Rosenfeld, R. M. (2004). Otitis media. *Lancet, 363*(9407), 465-473. doi: 10.1016/S0140-6736(04)15495-0

Ryborg, C. T., Sondergaard, J., Lous, J., Munck, A., Larsen, P. V., & Thomsen, J. L. (2014). Quality of life in children with otitis media--a cohort study. *Fam Pract, 31*(1), 30-37. doi: 10.1093/fampra/cmt066

Saafan, M. E., Ibrahim, W. S., & Tomoum, M. O. (2013). Role of adenoid biofilm in chronic otitis media with effusion in children. *Eur Arch Otorhinolaryngol, 270*(9), 2417-2425. doi: 10.1007/s00405-012-2259-1

Salomonsen, R. L., Hermansson, A., & Caye-Thomasen, P. (2010). Ossicular bone modeling in acute otitis media. *Otol Neurotol, 31*(7), 1109-1114. doi: 10.1097/MAO.0b013e3181e9becb

Scarinci, N., Worrall, L., & Hickson, L. (2008). The effect of hearing impairment in older people on the spouse. *Int J Audiol, 47*(3), 141-151. doi: 10.1080/14992020701689696

Scherer, M. J., & Frisina, D. R. (1998). Characteristics associated with marginal hearing loss and subjective well-being among a sample of older adults. *J Rehabil Res Dev, 35*(4), 420-426.

Schilder, A. G., Chonmaitree, T., Cripps, A. W., Rosenfeld, R. M., Casselbrant, M. L., Haggard, M. P., & Venekamp, R. P. (2016). Otitis media. *Nat Rev Dis Primers, 2*, 16063. doi: 10.1038/nrdp.2016.63

Schillinger, D., & Davis, T. (2005). A conceptual framework for the realtionship between health literacy and health care outcomes: the chronic disease exemplar. In J. Schwartzberg, J. VanGeest, C. Wang & editors. (Eds.), *Understanding Health Literacy: Implcations for Medicine and Public Health.* Chicago: AMA Press.

Schwartz, D. M., & Schwartz, R. H. (1978). Acoustic impedance and otoscopic findings in young children with Down's syndrome. *Arch Otolaryngol, 104*(11), 652-656.

Senturia, B. H., Bluestone, C. D., Lim, D. J., Klein, J. O., & Paradise, J. L. (1980). Report of the ad hoc committee on definition and classification of otitis media and otitis media with effusion. *Annals of Otology, Rhinology & Laryngology, 89*(3_suppl), 3-4. doi:10.1177/00034894800890s303

Shaikh, N., Hoberman, A., Kaleida, P. H., Ploof, D. L., & Paradise, J. L. (2010). Videos in clinical medicine. Diagnosing otitis media--otoscopy and cerumen removal. *N Engl J Med, 362*(20), e62. doi: 10.1056/NEJMvcm0904397

Shay, L. A., & Lafata, J. E. (2015). Where is the evidence? A systematic review of shared decision making and patient outcomes. *Med Decis Making, 35*(1), 114-131. doi: 10.1177/0272989X14551638

Shekelle, P., Takata, G., Chan, L. S., Mangione-Smith, R., Corley, P. M., Morphew, T., & Morton, S. (2002). Diagnosis, natural history, and late effects of otitis media with effusion. *Evid Rep Technol Assess (Summ)*(55), 1-5. doi: 10.1037/e439822005-001

Shieh, C., & Hosei, B. (2008). Printed health information materials: evaluation of readability and suitability. *J Community Health Nurs, 25*(2), 73-90. doi: 10.1080/07370010802017083

Shoemaker, S. J., Wolf, M. S., & Brach, C. (2014). Development of the Patient Education Materials Assessment Tool (PEMAT): a new measure of understandability and actionability for print and audiovisual patient information. *Patient Educ Couns, 96*(3), 395-403. doi: 10.1016/j.pec.2014.05.027

Simmons, L. A., Wolever, R. Q., Bechard, E. M., & Snyderman, R. (2014). Patient engagement as a risk factor in personalized health care: a systematic review of the literature on chronic disease. *Genome Med, 6*(2), 16. doi: 10.1186/gm533

Sipila, M., Karma, P., Pukander, J., Timonen, M., & Kataja, M. (1988). The Bayesian approach to the evaluation of risk factors in acute and recurrent acute otitis media. *Acta Otolaryngol, 106*(1-2), 94-101. doi:10.3108/0001648880910735

Song, H., Omori, K., Kim, J., Tenzek, K. E., Morey Hawkins, J., Lin, W. Y., . . . Jung, J. Y. (2016). Trusting Social Media as a Source of Health Information: Online Surveys Comparing the United States, Korea, and Hong Kong. *J Med Internet Res, 18*(3), e25. doi: 10.2196/jmir.4193

Stableford, S., & Mettger, W. (2007). Plain language: a strategic response to the health literacy challenge. *J Public Health Policy, 28*(1), 71-93. doi: 10.1057/palgrave.jphp.3200102

Stacey, D., Bennett, C. L., Barry, M. J., Col, N. F., Eden, K. B., Holmes-Rovner, M., . . . Thomson, R. (2011). Decision aids for people facing health treatment or screening decisions. *Cochrane Database Syst Rev*(10), CD001431. doi: 10.1002/14651858.CD001431.pub3

Stephenson, P. L. (2006). Before the teaching begins: Managing patient anxiety prior to providing education. *Clin J Oncol Nurs, 10*(2), 241-245. doi: 10.1188/06.CJON.241-245

Stevenson, J., Kreppner, J., Pimperton, H., Worsfold, S., & Kennedy, C. (2015). Emotional and behavioural difficulties in children and adolescents with hearing impairment: a systematic review and meta-analysis. *Eur Child Adolesc Psychiatry, 24*(5), 477-496. doi: 10.1007/s00787-015-0697-1

Strathdee-Goomes, A. (2019.). *Readability and quality of online hearing-related information in Spanish.* University of Canterbury., Christchurch, New Zealand.

Svider, P. F., Agarwal, N., Choudhry, O. J., Hajart, A. F., Baredes, S., Liu, J. K., & Eloy, J. A. (2013). Readability assessment of online patient education materials from academic otolaryngology-head and neck surgery departments. *Am J Otolaryngol, 34*(1), 31-35. doi: 10.1016/j.amjoto.2012.08.001

Teele, D. W., Klein, J. O., & Rosner, B. (1989). Epidemiology of otitis media during the first seven years of life in children in greater Boston: a prospective, cohort study. *J Infect Dis, 160*(1), 83-94. doi: 10.1093/infdis/160.1.83

Thoren, E. S., Oberg, M., Wanstrom, G., Andersson, G., & Lunner, T. (2013). Internet access and use in adults with hearing loss. *J Med Internet Res, 15*(5), e91. doi: 10.2196/jmir.2221

Tong, S., Amand, C., Kieffer, A., & Kyaw, M. H. (2018). Trends in healthcare utilization and costs associated with acute otitis media in the United States during 2008-2014. *BMC Health Serv Res, 18*(1), 318. doi: 10.1186/s12913-018-3139-1

Tonsaker, T., Bartlett, G., & Trpkov, C. (2014). Health information on the Internet: gold mine or minefield? *Can Fam Physician, 60*(5), 407-408.

Turk, A., & Shattuck-Hufnagel, S. (2014). Timing in talking: what is it used for, and how is it controlled? *Philos Trans R Soc Lond B Biol Sci, 369*(1658), 20130395. doi: 10.1098/rstb.2013.0395

U.S. Department of Health and Human Services Office of Disease Prevention and Health Promotion. (2010). *National Action Plan to Improve Health Literacy*. Washington DC.

van Zon, A., van der Heijden, G. J., van Dongen, T. M., Burton, M. J., & Schilder, A. G. (2012). Antibiotics for otitis media with effusion in children. *Cochrane Database Syst Rev*(9), CD009163. doi: 10.1002/14651858.CD009163.pub2

Venekamp, R. P., Damoiseaux, R. A., & Schilder, A. G. (2014). Acute otitis media in children. *BMJ Clin Evid, 2014*.

Vermeir, P., Vandijck, D., Degroote, S., Peleman, R., Verhaeghe, R., Mortier, E., . . . Vogelaers, D. (2015). Communication in healthcare: a narrative review of the literature and practical recommendations. *Int J Clin Pract, 69*(11), 1257-1267. doi: 10.1111/ijcp.12686

Wagner, T. H., Bundorf, M. K., Singer, S. J., & Baker, L. C. (2005). Free internet access, the digital divide, and health information. *Med Care, 43*(4), 415-420. doi: 10.1097/01.mlr.000015687.14152.6e

Wallace, L. S., Turner, L. W., Ballard, J. E., Keenum, A. J., & Weiss, B. D. (2005). Evaluation of web-based osteoporosis educational materials. *J Womens Health (Larchmt), 14*(10), 936-945. doi: 10.1089/jwh.2005.14.936

Wang, L. W., Miller, M. J., Schmitt, M. R., & Wen, F. K. (2013). Assessing readability formula differences with written health information materials: application, results, and recommendations. *Res Social Adm Pharm, 9*(5), 503-516. doi: 10.1016/j.sapharm.2012.05.009

Weiss, B. (2003). Health literacy. *American Medical Association*.

Weiss, B. (2007). *Health literacy and patient safety: help patients understand.* (2nd ed.). Chiacago: IL: American Medical Association Foundation and American Medical Association.

Whittemore, K. R., Jr. (2013). What is the role of tympanostomy tubes in the treatment of recurrent acute otitis media? *Laryngoscope, 123*(1), 9-10. doi: 10.1002/lary.23601

Win, K. T., Hassan, N. M., Bonney, A., & Iverson, D. (2015). Benefits of online health education: perception from consumers and health professionals. *J Med Syst, 39*(3), 27. doi: 10.1007/s10916-015-0224-4

Wong, K., Gilad, A., Cohen, M. B., Kirke, D. N., & Jalisi, S. M. (2017). Patient education materials assessment tool for laryngectomy health information. *Head Neck, 39*(11), 2256-2263. doi: 10.1002/hed.24891

Woodfield, G., & Dugdale, A. (2008). Evidence behind the WHO guidelines: hospital care for children: what is the most effective antibiotic regime for chronic suppurative otitis media in children? *J Trop Pediatr, 54*(3), 151-156. doi: 10.1093/tropej/fmn042

World Health Organisation. (2018). *Who regional offices.* Retrieved from https://www.who.int/about/who-we-are/regional-offices

World Health Organisation. (2019). *Deafness and hearing loss. Fact sheet.* Retrieved from https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss

Yoon, J. S., Lee, S. J., Kim, E. S., Kim, S. K., Jung, M. K., Lee, H. S., . . . Yeo, S. J. (2019). Quality of information on the Internet for Korean patients with inflammatory bowel disease. *Korean J Intern Med, 34*(6), 1215-1222. doi: 10.3904/kjim.2018.019

Yoshinaga-Itano, C., & Apuzzo, M. L. (1998). The development of deaf and hard of hearing children identified early through the high-risk registry. *Am Ann Deaf, 143*(5), 416-424. doi:10.1353/aad.2012.0118

Yuce, S., Polat, K., Onder, I., Dogan, M., & Muderris, S. (2013). Chronic otitis media with multiple complications. *J Craniofac Surg, 24*(4), e403-405. doi: 10.1097/SCS.0b013e318292c7b6

Zheng, J., & Yu, H. (2017). Readability Formulas and User Perceptions of Electronic Health Records Difficulty: A Corpus Study. *J Med Internet Res, 19*(3), e59. doi: 10.2196/jmir.6962

Zhou, L., Zhang, D., Yang, C., & Wang, Y. (2018). Harnessing Social Media for Health Information Management. *Electron Commer Res Appl, 27*, 139-151. doi: 10.1016/j.elerap.2017.12.003

Appendix A

Appendix A1: Ethics Approval Letter

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2019/07/LR

8 April 2019

Ana Blagojevic, Aynsley Hickson, Carol Hewitt, Katie Murphy, and Sarah Folkerts
Psychology, Speech and Hearing
UNIVERSITY OF CANTERBURY

Dear Ana, Aynsley, Carol, Katie, and Sarah

Thank you for your request for an amendment to your research proposal "Quality of Hearing-Related Internet Information" as outlined in your email dated 2nd April 2019.

I am pleased to advise that this request has been considered and approved by the Human Ethics Committee.

Yours sincerely

Dr Dean Sutherland
Chair, Human Ethics Committee

Appendix A2: Participation Information Sheet

Readability and Quality of Online Hearing-Related Material in English

My name is Julia Lee. I am a second year, Master of Audiology student at the University of Canterbury. I am conducting a research study that aims to assess the readability and quality of online hearing information.

Who is being sought?

Adults who are able to read in the English language.

Am I compensated for my time?

No.

What do I need to do?

Read the questions in the survey and provide answers. The questions will ask you about yourself (age, gender, and ethnicity) and will ask you to suggest some internet search terms to find online information about hearing disorders.

What else do I need to know?

Participation is voluntary and you have the right to withdraw or remove yourself from the survey and the research study at any stage without providing a reason or rationale. If you withdraw, all information relating to you will be removed unless data analysis has concluded. After data analysis has concluded, removal of individual data may not be practically achievable.

What happens to the study information or data?

A research thesis is a public document and will be available through the University of Canterbury Library. The results of the research project may be published in a peer-reviewed journal, but everyone taking part in the study may be assured of the confidentiality of all data gathered in this investigation. To ensure anonymity and confidentiality, data will be organised by a unique alpha-numeric code. All research information will be stored in password-protected electronic formats, in keypad locked, research labs at the University of Canterbury. Only the researcher, supervisor, and co-supervisors will have access. Data will

be kept for a period of five years before it is destroyed, per University of Canterbury Human Ethics Committee and research protocols.

What if I want to know about how the research study turned out?

Tick the box on the consent form if you want to receive a summary of the results of the study.

Who is supervising the research study?

The research project is being carried out as a requirement for the Master of Audiology degree at the University of Canterbury. The primary supervisor is research study is Dr. Rebecca Kelly-Campbell - rebecca.kelly@canterbury.ac.nz. In addition, the study is being co-supervised by Megan McAuliffe – megan.mcauliffe@canterbury.ac.nz.

Who approved this research study?

This project was reviewed and approved by the University of Canterbury Human Ethics Committee. Participants wishing to lodge a complaint should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

Appendix A3: Consent Form

By clicking the continue button, I agree to take part in the research project and confirm I understand the following:

- The information about this research study has been explained to me to my satisfaction. I have had the chance to ask questions.
- I know what I need to do to take part in the study.
- I know that I can choose whether or not I take part in this research. I know that I may withdraw from the study without penalty by exiting the survey without submitting my answers.
- I know that any information or opinions I give will be kept private to the researcher. I know that any published or reported results will not identify me.
- I know that all data collected for the study will be kept in locked and secure facilities or in password protected computers and will be destroyed after ten years.
- I will be given a copy of this form and the Research Information Sheet.
- I know that I can contact the researcher for more information: Julia Lee: julia.lee@pg.canterbury.ac.nz or the primary supervisor, Dr Rebecca Kelly-Campbell: rebecca.kelly@canterbury.ac.nz, (03) 369 4519.
- If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz, (03) 364 2987 ext45588).
- I know that if I would like a copy of the study results, I need to contact Julia Lee: julia.lee@pg.canterbury.ac.nz.

Appendix B

Appendix B1: DISCERN

Provide a rating for each item below from 1 to 5. Use the following anchors: 1 = No, 3 = Partially, 5 = Yes

Section 1: Is the publication reliable?

Criterion	Rating
1. Are the aims clear? a. Look for Look for a clear indication at the beginning of the publication of: i. what it is about ii. what it is meant to cover (and what topics are meant to be excluded) iii. who might find it useful **b. If the answer to Question 1 is 'No', go directly to Question 3**	
2. Does it achieve its aims? a. Consider whether the publication provides the information it aimed to as outlined in Question 1.	
3. Is it relevant? a. Consider whether the publication addresses the questions that readers might ask b. Consider whether recommendations and suggestions concerning treatment choices are realistic or appropriate	
4. Is it clear what sources of information were used to compile the publication (other than the author or producer)? a. Check whether the main claims made about treatment choices are accompanied by a reference to the sources used as evidence (e.g., a research study or expert opinion) b. Look for a means of checking the sources used such as a bibliography/reference list or the addresses of the experts or organisations quoted c. In order to score a full "5" the publication should fulfil both a & b. d. Lists of additional sources of support and information are not necessarily sources of evidence for the current publication.	
5. Is it clear when the information used or reported in the publication was produced? a. Look for dates of the main sources of information used to compile the publication b. Look for date of any relevant revisions of the publication (but not dates of reprinting) c. Look for date of publication (copyright date) d. These are in order of importance – in order to score a full "5" the dates relating to (a) should be found.	
6. Is it balanced and unbiased? a. Look for a clear indication of whether the publication is written from a personal or objective point of view b. Look for evidence that a range of sources of information was used to compile the publication (e.g., more than one research study or expert) c. Look for evidence of an external assessment of the publication – be wary if i. the publication focuses on the advantages or disadvantages of one particular treatment choice without reference to other possible choices ii. the publication relies primarily on evidence from single cases (which may not be typical of people with this condition or of responses to a particular treatment) iii. the information is presented in a sensational, emotive or alarmist way	
7. Does it provide details of additional sources of support and information? a. Look for suggestions for further reading or for details of other organisations providing advice and information about the condition and treatment choices	
8. Does it refer to areas of uncertainty?	

a. Look for discussion of the gaps in knowledge or differences in expert opinion concerning treatment choices b. Be wary if the publication implies that a treatment choice affects everyone in the same way (e.g., 100% success rate with a particular treatment)	

Section 2: How good is the quality of information on treatment choices?

The questions apply to the treatment (or treatments) described **in the publication**. Self-care is considered a form of treatment throughout this section.

Criterion	Rating
9. Does it describe how each treatment works? a. Look for a description of how a treatment acts on the body to achieve its effect.	
10. Does it describe the benefits of each treatment? a. Benefits can include controlling or getting rid of symptoms, preventing recurrence of the condition and eliminating the condition – both short-term and long-term	
11. Does it describe the risks of each treatment? a. Risks can include side effects, complications and adverse reactions to treatments - both short-term and long-term	
12. Does it describe what would happen if no treatment is used? a. Look for a description of the risks and benefits of postponing treatment, of watchful waiting (i.e., monitoring how the condition progresses without treatment) or of permanently forgoing treatment	
13. Does it describe how the treatment choices affect overall quality of life? a. Look for description of the effects of the treatment choices on day-to-day activity b. Look for description of the effects of the treatment choices on relationships with family, friends, and carers	
14. Is it clear that there may be more than one possible treatment choice? a. Look for a description of who is most likely to benefit from each treatment choice mentioned and under what circumstances b. Look for suggestions of alternatives to consider or investigate further (including choices not fully described in the publication) before deciding whether to select a particular treatment choice	
15. Does it provide support for shared decision-making? a. Look for suggestions of things to discuss with family, friends, doctors or other health professionals concerning treatment choices	

Section 3: Overall rating of the publication

Criterion	Rating
16. Based on the answers to all the above questions, rate the overall quality of the publication source of information about treatment choices: 1-2: Low: Serious or extensive shortcomings 3-4: Moderate: Potentially important but not serious shortcomings 5: High: Minimal shortcomings	

Appendix B2: PEMAT

Understandability

Item Number	Item	Response options	Rating
Topic: content			
1	The material makes its purpose completely evident (P and A/V) • Is there a clear indication of what the material is going to be about? • OR what it is meant to cover i.e. topics which will be covered within the material at the start OR throughout (as an example, headings)	Disagree = 0, Agree = 1	
Topic: Word choice and Style			
2	The material does not include information or content that distracts from its purpose (P) • Material should contain majority relevant information that addresses the purpose	Disagree = 0, Agree = 1	
3	The material uses common, everyday language (P and A/V) • No use of jargon without defining it in everyday language • No use of legal terms, abbreviations, acronyms or technical terms – only if reader needs to know them and if used they are explained.	Disagree = 0, Agree = 1	
4	Medical terms are used only to familiarize audience with the terms. When used, medical terms are defined (P and A/V)	Disagree = 0, Agree = 1	
5	The material uses the active voice (P and A/V) • If both active and passive voice is used, then disagree	Disagree = 0, Agree = 1	
Topic Use of Numbers			
6	Numbers appearing in the material are clear and easy to understand (P) • Proportions or percentages ok e.g. 1 in 1000 (agree) • Time is ok e.g. within 2 weeks (agree) • If units are explained (e.g. 30 dB decibels are a measure of sound intensity) agree • If use p values, SFs, disagree • For any large numbers e.g. 6300000 they need to be written to agree e.g. 6.3 million • For any population statistic, they need to be defined e.g. worldwide, nationwide	Disagree = 0, Agree = 1, No numbers = N/A	
7	The material does not expect the user to perform calculations (P) • If there is one easy to use inbuilt formula/calculator then agree, if more than one then disagree	Disagree = 0, Agree = 1	
Topic: Organization			
8	The material breaks or "chunks" information into short sections (P and A/V) • Material contains paragraphs if longer than half a page	Disagree = 0, Agree = 1	

	• Paragraphs are no longer than half a page • Multiple paragraphs within a section are ok		
9	The material's sections have informative headers (P and A/V) • Headers are relevant to following section (headings or titles) • Material has headings	Disagree = 0, Agree = 1, Very short material * = N/A	
10	The material presents information in a logical sequence (P and A/V) • If providing chronological information must in be in chronological order to agree • Follows aims if there are aims (agree) • Follows order of headings if headings given (agree)	Disagree = 0, Agree = 1	
11	The material provides a summary (P and A/V) • Summary must be of whole material. Can be present at start or end, or on side.	Disagree = 0, Agree = 1, Very short material * = N/A	
Topic: Layout and Design			
12	The material uses visual cues (e.g., arrows, boxes, bullets, bold, larger font, highlighting) to draw attention to key points (P and A/V)	Disagree = 0, Agree = 1	
13	Text on screen is easy to read (A/V) • Agree if you can read easily on phone screen or bigger • Disagree if you can't read on your phone	Disagree = 0, Agree = 1	
14	The material allows the user to hear the words clearly (e.g., not too fast, not garbled) (A/V)	Disagree = 0, Agree = 1	
Topic: Use of visual aids			
15	The material uses visual aids whenever they could make content more easily understood (e.g., illustration of healthy portion size) (P) • images are used if appropriate and aid in a confusing topic	Disagree = 0, Agree = 1	
16	The material's visual aids reinforce rather than distract from the content (P) • if image does not relate to content then disagree	Disagree = 0, Agree = 1, No visual aids = N/A	
17	The material's visual aids have clear titles or captions (P)	Disagree = 0, Agree = 1, No visual aids = N/A	
18	The material uses illustrations and photographs that are clear and uncluttered (P and A/V)	Disagree = 0, Agree = 1, No visual aids = N/A	
19	The material uses simple tables with short and clear row and column headings (P and A/V)	Disagree = 0, Agree = 1, No visual aids = N/A	

*A very short print material is defined as a material with two or fewer paragraphs and no more than 1 page in length.

Actionability

Item Number	Item	Response Options	Rating
20	The material clearly identifies at least one action the user can take (P and A/V)	Disagree=0, Agree=1	
21	The material addresses the user directly when describing actions (P and A/V) • Talks in first person for actions • if talks in third person then disagree	Disagree=0, Agree=1	
22	The material breaks down any action into manageable, explicit steps (P and A/V) • If a single step action then agree e.g. you need to go to A & E immediately if you see bone coming out of your skin	Disagree=0, Agree=1	
23	The material provides a tangible tool (e.g., menu planners, checklists) whenever it could help the user take action (P) • if action requires less than 3 steps, then no tool is required and agree	Disagree=0, Agree=1	
24	The material explains how to use the charts, graphs, tables, or diagrams to take actions (P and A/V)	Disagree=0, Agree=1, No charts, graphs, tables, or diagrams=N/A	
25	The material uses visual aids whenever they could make it easier to act on the instructions (P) • Agree if at least 1 visual aid that is helpful for taking action	Disagree=0, Agree=1	

Appendix B3: Plain Language

Reader Focus	**Yes**	**No**
Does one or more of the headings contain the topic of interest?		
Does the introduction (first paragraph) inform the reader what they are about to read?		
Is the content relevant to the topic of interest?		
Organisation		
Does the material begin with the most important message of that webpage/video?		
Is the content arranged in a sensible order?		
Are different topics grouped under separate headings or subheadings?		
Writing		
Are personal pronouns such as “you” and “we” used throughout?		
Is an active voice used throughout?		
Are lay terms predominately used throughout?		
If technical terms are used, are they explained?		
Are simple sentences used throughout (i.e. no more than one new idea per sentence)?		
Is correct grammar used throughout?		
Is correct punctuation used throughout?		
Are unnecessary words eliminated (e.g. technical jargon or adverbs)?		
Design & Formatting		
Is the appearance of the material consistent throughout (i.e. consistent use of fonts, italics, bold print, colour, and bullet points)?		
Does the material look easy to read, with an uncluttered layout, plenty of white space, and dark text on a light background or light text on a dark background?		
Are the fonts clean in their design and easy to read (not fancy or unusual, e.g. Arial)?		
Is the text size large enough for easy reading and does each line have about 10-15 words?		
Are italics, underlining, capitalisation, and bold print used sparingly?		
Are images clear and uncluttered and related to the content?		